Subterranea

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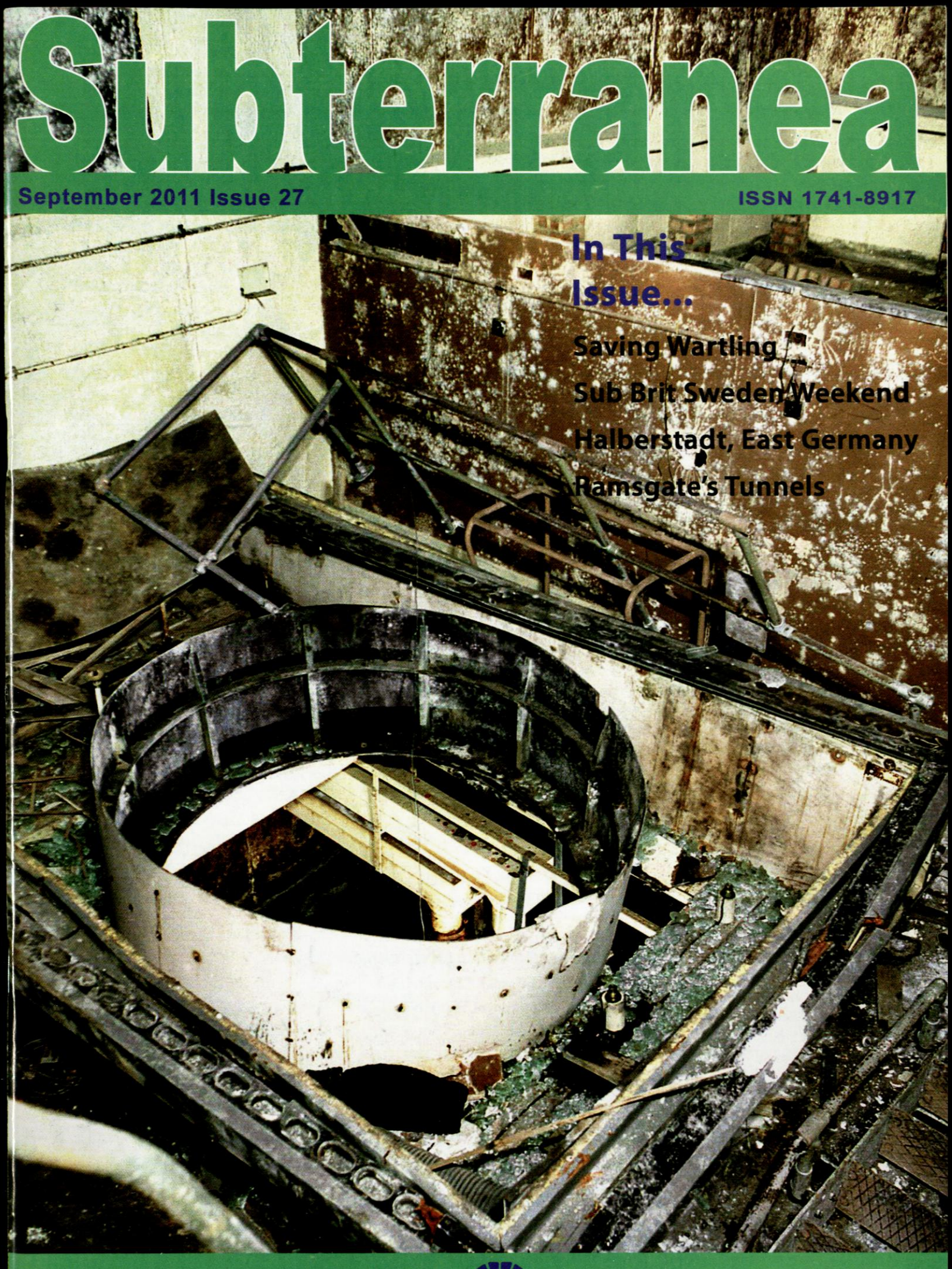

In This Issue...

Subterranea Britannica

www.subbrit.org.uk

Subterranea Britannica is a society devoted to the study of man-made and man-used underground structures and the archaeology of the Cold War. The society is open to all and its membership includes all walks of life. Members are invited to contribute to this magazine even if this just means sending very welcome snippets from newspapers and magazines.

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Contents

Front cover photo: Mounting for the plotting table above the Kelvin Hughes projector in the R3 bunker at RAF Wartling. Apart from the museum bunker at Holmpton, Wartling is the only Rotor radar station where any part of the Kelvin Hughes projector mounting survives. Photo by Nick Catford

Back page upper: Group photo outside the western entrance to the Brunkebergstunneln during the Sub Brit Swedish weekend in May 2011. This is just 100 metres from the place where Swedish Prime Minister Olof Palme was shot dead 25 years ago. Photo Lars Hansson

Back page lower: The Ramsgate Harbour railway tunnel in 1984. After closure of the passenger line between Dumpton Park and Ramsgate Harbour in 1926 the tunnel was brought back into use as a tourist attraction in 1936. The narrow gauge Ramsgate Tunnel Railway ran from Beach station close to the site of the old Ramsgate Harbour station utilising the first 800 yards of the old Harbour tunnel. The line then curved to the north west in a new 300 yard spur tunnel emerging into a new station at Hereson Road. This view shows the junction of the spur tunnel with the Harbour tunnel. Both tunnels were used as an air raid shelter in WW2. Photo Nick Catford

Newsletters of Subterranea Britannica are published by the committee of Subterranea Britannica. Original articles, book reviews, press cuttings, extracts from books and journals, letters to the Editor etc are welcome. However the Editor reserves the right not to publish material without giving a reason.

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Chairman's Welcome

Martin Dixon

Tuesday 19 April 2011 was a red-letter day for Subterranea Britannica. After many years of discussion and preparation, our society formally gained charitable status. The Charities Commission allocated us registration number 1141524 and our existing Directors also became the Charity's Trustees.

So what difference will this make to our day-to-day activities? The answer is both 'not a lot' and 'a great deal'.

In order to gain charitable status, our existing Memorandum and Articles of Association were amended only slightly (see the EGM Minutes elsewhere in this magazine). As such the society's objectives, governance and day-to-day activities will remain largely unchanged. Our events, publications, website, members and committee will continue to focus on our subterranean heritage.

On other levels, however, this change in status gives Subterranea Britannica new opportunities and responsibilities.

Firstly, a prime test of all registered charities is that their aims and output are 'for the Public Benefit'. The fact that our website, publications and formal day meetings remain accessible to the general public is one aspect of this. There is no barrier to membership-based charities, (think of the National Trust and the RSPB, two of England's largest) but membership must be open to all (which it always has been) and must not confer exclusive material benefits.

Secondly, our status as a charity adds to our standing in society. Our decision to seek charitable status well predates David Cameron's 'Big Society' ideas but we can now more clearly show that we are a serious organisation with well respected credentials. Being a charity raises our credibility with individuals, other groups and the general public, and may well help open doors – real and virtual – in the future.

A final group of opportunities that arise from our being registered as a charity are financial. Subject to separate approval from H M Revenue and Customs (application pending), Sub Brit membership subscriptions and donations are potentially eligible for Gift Aid. This benefits Sub Brit as a donation of £1 becomes worth £1.25 after our reclaiming tax from HMRC. Donors have to be UK tax-payers in order for Gift Aid to apply. Donors who are lucky enough to be higher-rate tax payers can also benefit by claiming twenty percent of their gross donation off their tax bill.

Many trusts and foundations award grants exclusively to registered charities so the way is open, should we so decide, to apply for grant-aid for specific projects. More sombrely, legacies to charities are exempt from inheritance tax and may even reduce tax liability of the residue of an individual's estate. We obviously wish all of our members a long and fruitful life, but if you *are* writing a will, then please at least consider including Sub Brit as a beneficiary.

There are many ways in which Sub Brit could use the extra funds generated. For example, to fund the recording, interpretation or preservation of individual sites – this summer we are already involved in work at Coleshill, Wartling, Barnet and Paddock (Dollis Hill). We could support the publication (online and in hard copy) of additional material that explains the pivotal role that underground space has played in mankind's history. Desktop and classroom activities are as important as 'hands on' site-work. The list is endless and will help Subterranea Britannica continue to leave its mark on a growing population.

In reaching this milestone the Committee in general, and Sue Monsell and I in particular, have spent long hours completing forms, gathering supporting evidence and answering questions. I, for one, feel this is an investment that will pay back many times over in the years to come.

chairman@subbrit.org.uk

Subterranea Britannica Autumn Meeting

Saturday 15th October 2011

Royal School of Mines, Imperial College, London

Dr David Walker, speaking about the Nottingham Caves Survey. David uses the latest laser-scanning technology to produce incredibly detailed surveys of the city's many underground spaces

Peter Kendall, English Heritage (Inspector of Ancient Monuments for Kent), speaking about below-ground aspects of the Chatham forts

Mrs Helen Mills – "Four Years as a Plotter". We are privileged to have a speaker with first-hand experience of being a plotter in the bunker Ops room at RAF Uxbridge and Gibraltar during WWII

Mike Barton concluding his talk on Brixmis and Cold War missions.
Ex-'Missionaries' should also be in attendance

Further details on speakers – please contact Chris Rayner on Chris_Rayner@btconnect.com

To book, please use the booking form enclosed in this issue or book online at www.subbrit.org.uk

ANNUAL GENERAL MEETING 2011 - MINUTES

9th April 2011 at 10.05am

Imperial College Huxley Building, 180 Queens Gate, South Kensington, London SW7 2AZ

The meeting was opened by the Chairman, Martin Dixon, who welcomed all those attending – especially new members. Andrew Smith was thanked for acting as host and taking care of the audio-visual equipment.

1. Apologies were received from John Gurney, Alasdair Kergon, Stewart Wild, John Lill, Mark Russell, Richard Seabrook, Dom Jackson, Tiny Williams and John Burgess.
2. The motion to adopt the Minutes of 17th April 2010, was proposed by Linda Bartlett, seconded by Hugh Ainsley, and passed *"nem con"*.
3. The Chairman took the opportunity to highlight some of the key achievements of the past twelve months, as recorded in the Chairman's Report (which had been circulated in advance of the meeting):
    - Three issues of *Subterranea* published
    - A record number of site visits
    - A study weekend in Cornwall
    - Spring & Autumn day meetings
    - Two open days at Paddock
    - Three committee meetings
    - Over 1,000 concurrent members
    - Publication of the "Corsham" special
    - Publishing an index for *Subterranea*
    - Relaunch of the Sub Brit website
    - Conducting a membership survey
4. There were no questions relating to the Accounts for the year ended 31st December 2010 (which had been previously circulated). The Chairman said that Sue Monsell had announced her intention to standdown as Treasurer as soon as a replacement could be recruited, and thanked her for all her hard work in the role.
5. The Chairman introduced the motion, on behalf of the committee, that "annual subscriptions for UK members should be increased to £19, and for overseas members to £28, with effect from 2012". He explained that Sub Brit was faced with steadily increasing expenses such as postage, and that it was prudent to ensure that finances remained healthy. The increase had been limited to £1 (£2 overseas) because of the possibility that subscriptions to Sub Brit would qualify under the Gift Aid scheme. The Membership Secretary noted that a number of members made donations in addition to their membership fee. A motion to accept the proposal was made by Bob Clary, seconded by Tim Robinson, and passed *"nem con"*.
6. A motion that "nominations for election be considered "en bloc" was proposed by Chris Hobdale, seconded by Mike Stace, and passed "*nem con*".
7. A motion to elect the following Officers and Committee for 2011/2012 was proposed by Richard West, seconded by Roy Kenneth, and passed *"nem con"*.
    - Martin Dixon (Chairman)
    - Linda Bartlett (Vice Chairman)
    - Sue Monsell (Treasurer)
    - Roger Starling (Secretary)
    - Nick Catford (Membership Secretary)
    - Paul Sowan (Member)
    - Bob Templeman (Member)
    - Hugh Ainsley (Member) (now resigned)
    - Mark Russell (Member)
    - Richard Seabrook (Member)
    - Andrew Smith (Member)

The meeting closed at 10.20am.

EXTRAORDINARY GENERAL MEETING 2011 - MINUTES

9th April 2011 at 10.20am

Imperial College Huxley Building, 180 Queens Gate, South Kensington, London SW7 2AZ

The Chairman introduced a proposal (which had been previously circulated to all members) to change clause 3 of the Memorandum of Association of Subterranea Britannica by way of Special Resolution, as follows:

It is proposed to replace the Objects Clause (clause 3) of the Subterranea Britannica Memorandum of Association which reads:

The objects for which the company is established are for the public benefit. To encourage and promote the study of all aspects of underground objects spaces and structures (whether excavations or structures or partly one and partly the other) of any kind or period made or used by human beings both generally and particularly within the British Isles and world-wide without precise geographical limitation, and the doing of all such other things as are incidental or conducive to the attainment of that object.

With:

The objects for which the company is established are to advance education and science for the public benefit by the study, understanding, recording and (where practical) the preservation and protection of man-made and man-used underground structures, objects and spaces.

The Chairman explained the rationale for the proposal, which was necessary to comply with the requirements of the Charities Commission.

Richard Lamont asked about the background to the proposed new objects and indicated his opposition. The Chairman said that the new objects did not represent a material change to the society's remit but that members were entitled to speak and vote against the motion.

A motion to accept the Special Resolution was proposed by Paul Sowan and seconded by Tim Robinson.

The Special Resolution was passed with 67 members voting in favour (93% of those present), one vote against and four abstentions.

The meeting closed at 10.40am.

SUBTERRANEA BRITANNICA DIARY

Summary of Forthcoming Events 2011-12

Sub Brit specific events

8 October SB Committee Meeting

15 October SB Autumn Day Meeting – London

1 November Copy deadline for *Subterranea 28*

Mid-December *Subterranea 28* published

28 January 2012 SB Committee meeting

17 March 2012 Hack Green open for SB members

14 April (provisional) SB Spring Meeting and AGM

September 2012 SB UK Visits weekend – Sussex

Other underground-related events

8 – 11 September Heritage Open Days across UK

10 September Reigate Caves & Barons' Cave Public Open Day
www.wcms.org.uk

10 September Not just Digging Trenches: Archaeology of WWI, London
www.warjaw.co.uk

13 September London Underground Railway Society (LURS)
Talk on potential Bakerloo Line extensions (www.lurs.org.uk)

17 – 18 September London Open House, including Paddock

11 October LURS talk on East London Line (www.lurs.org.uk)

8 November LURS talk on The London Underground – Then and Now
(www.lurs.org.uk)

For more information, email info@subbrit.co.uk or contact the Society concerned

NEWS – ARCHAEOLOGY

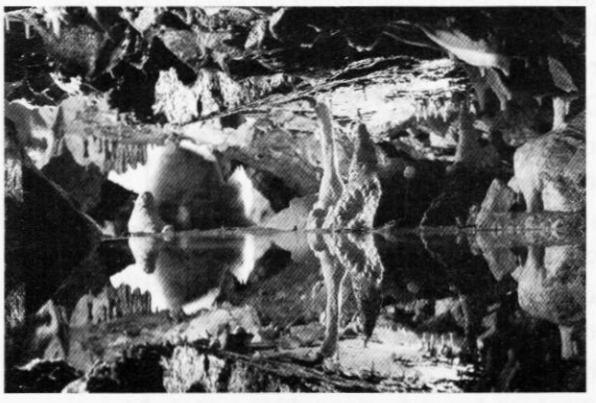
Ice Age human remains from Gough's Cave, Somerset

Gough's Cave, one of the commercialised natural solution caves in limestone at Cheddar Gorge, was discovered in 1890. The natural 50-metre-long cave contains (or in many instances once contained) deposits with human bones and associated artefacts (flint and antler tools) in them, excavated to more or less satisfactory archaeological standards from 1892 onwards. Marks on some of the bones are evidence for human use of tools for removing flesh from them, seen by some as indicative of cannibalism and by others as ritual preparation of the deceased for an afterlife as envisaged by our ancestors during the Ice Age.

Most of the skeletal remains, however, do not appear to have been deliberately and formally buried. A complete human skeleton, dubbed 'Cheddar man', came to light in 1903, dated to 10,250 years ago in the Mesolithic period. Some of the material is considerably older, from the Palaeolithic period. Some items have been dated as 12,000 to 14,700 years old. Marks studied on skulls from the cave have been shown to be deliberately made by cutting and percussion tools. An abundance of animal bones with marks also indicative of deliberate butchery suggests the inhabitants of the cave were well supplied with non-human meat.

To settle the question of cannibalism, a group of students were induced to chew meat off cooked pig and sheep bones. Marks left by the students' teeth on the bones strongly resemble those found on animal and human bones found in the cave. And analysis of cut marks on skulls is now seen as conclusive evidence that these were deliberately manufactured into food or drinking vessels.

SOURCE: BELLO, Silvia, Simon PARFITT, and Chris STRINGER, 2011, Gough's Cave, Somerset. *British Archaeology* 118 (May / June 2011), 14 – 21; and ANON, 2011, Cheddar skull cups. *Current Archaeology* 22(2)(254), page 8.



Deneholes or chalk-wells suggested associated with Lewes Castle, East Sussex

The imposing remains of Lewes Castle, towering over the town centre, include substantial standing stone walls, and two built mottes or mounds, one or both of which have been recorded as built at least in part of squared chalk blocks.

Recently reported archaeological excavation has revealed substantial rubbish-filled pits up to five metres deep into the underlying natural chalk, supposedly the origin of the building blocks. It has been further suggested that some of these pits, as revealed to date, may be the tops of mines of the 'denehole' or 'chalk-well' type, with vertical shafts communicating with mined chambers at depth. Post-holes seemingly associated with the extraction pits might represent former shaft-top buildings or lifting apparatus. Hitherto, deneholes and chalk-wells have usually been interpreted as medieval chalk mines for agricultural purposes, rather than quarries for building-stone.

SOURCE: SWIFT, Dan, 2011, Excavating medieval Lewes: from burgh to strategic stronghold. *Current Archaeology* 22(3)(255), 28 – 33.

Unknown human species identified from a cave site in Siberia

A fragment of a little-finger bone from a Siberian cave has yielded DNA from a human species that lived alongside the Neanderthals 30,000 years ago. Denisovan Man hails from the Denisova Cave in the Altai Mountains of southern Siberia. The entire human family is believed to have developed from beginnings in Africa, various species evolving independently as they spread through Europe and Asia, through the East Indies to Australia, and via the Bering Strait and Alaska into North and then South America. *Homo sapiens* is the only survivor, although comment has been made that he is currently proving to be too clever by half, and bent on self-destruction!

SOURCE: Hannah DEVLINM, 2010, Unknown species of man identified from cave DNA. *The Times*, 23 December 2010, page 17.

NEWS – CONSERVATION AND HERITAGE

Dunkirk display in tunnels at Dover Castle, Kent

Displays in the publicly visitable sections of the tunnels inside the cliff face below Dover Castle have been augmented with additional material relating to the evacuation of British troops from Dunkirk during World War II.

SOURCE: KENNEDY, Maev, 2011, Exhibition shines light in Dover tunnels to reveal untold story of Dunkirk evacuation. English Heritage unveils faces behind armada that helped turn Nazi tide. *The Guardian*, 7 June 2011, page 13.

Snibston Colliery, Coalville, Leicestershire

The Arts Council is funding an arts event called 'Transform' at the industrial heritage centre at Snibston, near Coalville, northwest Leicestershire. The Snibston Colliery was built by George Stephenson in 1832 and closed in the 1980s. It was reopened as an industrial heritage centre in 1992 / see / www.snibston.com .

SOURCE: ABEL, Carolyn, and Maurice MAGUIRE, 2011, Transform at Snibston Colliery. *Industrial Archaeology News* 157, page 2.

New World Heritage Site nominations from the UK and Gibraltar

The relevant bodies in the United Kingdom have nominated additional sites for UNESCO World Heritage Site status, including the following with significant subterranean interest:

Creswell Crags (Derbyshire / Nottinghamshire) – caves with significant archaeological remains including Ice Age 'cave art'

North Wales slate industry – including very large underground slate quarries

Gorham's Cave complex (Gibraltar)

Sadly, the nomination last year of Brunel's Great Western Railway (including of course Box and other tunnels) was not successful.

SOURCE: ANON, 2011, UK nominates eleven new World Heritage Sites. *Current Archaeology* 22(3)(255), page 7.

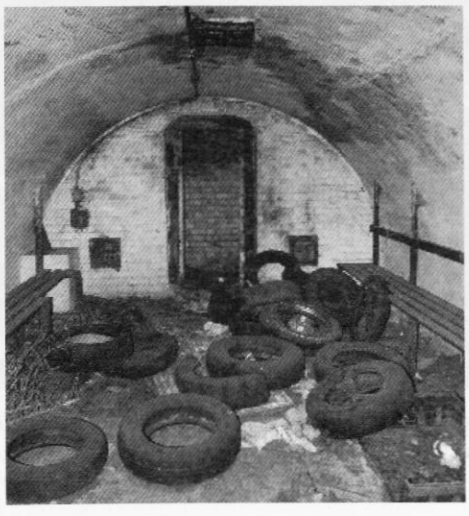
NEWS – MILITARY AND DEFENCE

Waverley Road air-raid shelter at risk, Plumstead, southeast London

A World War II air-raid shelter in Waverley Road, Plumstead, in the London Borough of Greenwich, is featured as one of six important but threatened archaeological sites. The shelter is described as having been constructed in an unusual way, and is unusually well preserved with surviving benches, electrical fittings, and provision for ventilation; and there is an intact urinal.

The construction is to a high standard, of prefabricated concrete sections, with brick blast walls and a door at each end. It is suggested it may have been built to central government specifications to shelter employees at the waterworks currently operating at the site, which is now likely to be redeveloped. Local residents are campaigning for the shelter's preservation and educational use.

SOURCE: BELLO, ANON, 2011, Six threatened sites. *British Archaeology* 118 (May / June 2011), 38 – 43.



Three former RGHQ bunkers go on the market

The Skendleby RGHQ and former rotor bunker near Alford in Lincolnshire has been sold. Many of you will have visited the bunker when we had a couple of open days there in the early 2000s when one member Sub Brit flew in by helicopter! Soon after our visit, the bunker was bought by former Sub Brit member Kelly Smith who established his company Centrinet there.

Centrinet and the bunker have now been bought out by GCI COM, a major player in the communications and hosting industry.

None of the former Centrinet directors are on the new company. The last member of the original Centrinet staff left the company at the end of July completing the full takeover.

Two other former RGHQs are also currently on the market. They are at Cultybraggan near Stirling and Hope Cove in Devon.

SOURCE: Nick Catford

The ventilation towers above the Skendleby RGHQ. Photo Nick Catford

Unearthing the hidden tunnel war

Archaeologists are beginning the most detailed ever study of a Western Front World War I battlefield, an untouched site where 28 British tunnellers lie entombed after dying during brutal underground warfare.

When military historian Jeremy Banning stepped on to a patch of rough scrubland in northern France four months ago, the hairs on the back of his neck stood up.

The privately owned land in the sleepy rural village of La Boisselle had been practically untouched since fighting ceased in 1918, remaining one of the most poignant sites of the Battle of the Somme.

In his hand was a selection of grainy photographs of some of the British tunnellers killed in bloody subterranean battles there, and who lay permanently entombed directly under his feet.

When most people think of WWI, they think of trench warfare interrupted by occasional offensives, with men charging between the lines. But with the static nature of

the war, military mining played a big part in the tactics on both sides. The idea of digging underneath fortifications in order to undermine them goes back to classical times at least. But the use of high explosive in WWI gave it a new dimension.

One of the most notable episodes was at the Battle of Messines in 1917 where 455 tons of explosive placed in 21 tunnels that had taken more than a year to prepare created a huge explosion that killed an estimated ten thousand Germans.

Tunnelling was mainly done by professional miners, sent from the collieries of Britain to the Western Front.

What happened at La Boisselle in 1915-16 is a classic example of mining and counter-mining, with both sides struggling desperately to locate and destroy each other's tunnels.

After six years of painstaking paper research by fellow historian Simon Jones, the researchers had built up detailed knowledge of the individual tragedies involved. They knew the exact locations and depths at which each man was lost, the circumstances of their deaths, and almost all of their names. And yet it was only when the owner of the site chose to open it up to research that they were able to finally connect the stories to the place.

The Lejeune family, who have owned the land since the 1920s, have a deep affinity with the site and have known many British veterans who served at La Boisselle. But it was only after visiting the team's excavations at nearby Mametz last May that they decided to offer their land up for historical study.

Archaeologists, historians and their French and German partners now aim to preserve the area – named the Glory Hole by British troops – as a permanent memorial to the fallen.

Digging does not start until next year, but the first practical steps of mapping the tunnels and trenches using ground-penetrating radar, and exploring the geophysics, are under way. Some open tunnel sections have already been entered and are considered remarkably well preserved.

The team intends to leave the bodies undisturbed in the collapsed tunnels, but any others found in trenches will be reburied in accordance with the Commonwealth War Graves Commission. Bomb disposal experts will be on standby to negotiate the unexploded ordnance they will inevitably uncover.

SOURCE: BBC News Magazine, 10 June 2011.

Demolition of remaining buildings at the Dollis Hill Post Office Research Station

In June 2011 work started to demolish many of the remaining buildings from the former Post Office Research Station at Dollis Hill, northwest London. The Post Office (BT) finally vacated the site in September 1976 when they relocated to Martlesham Heath in Suffolk. After a brief spell as the London headquarters of Cadbury Schweppes in the early 1980s, the site became the Dollis Hill Industrial Estate.

In May 1997 part of the site was acquired by Network Housing Association. Planning permission was obtained in November 1997 for 99 new homes including 37 new-build houses fronting on to Brook Road, NW2. The main Post Office building – which is locally listed by Brent Council – was retained and converted into 28 luxury flats.

The gates and Paddock bunker are also locally listed, and as part of the sale Brent Council required Network Housing to make the bunker safe and open it on at least two days a year to the general public. The bunker is still open on two days – one in May, the other in September – as part of London Open House weekend, with Subterranea Britannica providing free guided tours.

The remainder of the site remained as the Dollis Hill Trading Estate, eventually becoming the Evans Business Centre. Four of the buildings within the estate became Menorah High School for Girls, which opened in September 2001.

By 2009 most of the buildings had been vacated and in July 2010 a planning application was put before Brent Council for conversion of the largest building on the site (Building 15) into a new school building. Building 15 had previously been a school between 1979–1999 when it was the College of North West London. Since 1999 is has been put to light industrial use and offices. The remainder of the site was acquired by the Network Housing Group for residential redevelopment

The new school building was brought into use in June 2011 and the building has now been named Churchill House. Work began immediately to clear the remaining buildings ready for redevelopment. This will not affect the Paddock bunker in any way.

During an inspection of the buildings during Paddock Open Days, a number of the buildings appeared to have protected basements and in at least one building access to the basement was through a blast door.

SOURCE: Nick Catford and Committee Report – LB Brent Planning Committee, 15 September 2010.

The buildings due to be demolished are on the left. Building 15 is at the top and the Paddock bunker is below the houses on the right.

World War II air-raid shelter at Selsdon Park Hotel, Croydon

Correspondence (from PWS) with the Selsdon Park Hotel, Croydon, reveals that there is now no recognisable trace of the luxuriously appointed air-raid shelter constructed below the buildings at the start of World War II. The hotel has been extended and developed on several occasions since WWII, and it seems likely that such works have effectively obliterated any recognisable trace of the shelter.

Fort Halstead's Dstl research laboratory to close

A military research centre in Kent that employs 840 people is to close following a review. The Defence Science and Technology Laboratory (Dstl) said it had reviewed operations at its Fort Halstead site near Sevenoaks.

Dstl, which is part of the Ministry of Defence (MoD), said staff would be relocated elsewhere. It said staff would be moved to Portsdown West near Portsmouth, and Porton Down near Salisbury. QinetiQ, a defence technology company, will remain at the Fort Halstead site.

Fort Halstead is one of the largest employers in the Sevenoaks district. Staff carry out research and forensic science analysis into explosives. During the 1970s and 1980s, staff at Fort Halstead studied the bomb-making capabilities of Northern Ireland's paramilitary organisations.

The original Fort Halstead was one of the London mobilisation centres which were constructed between 1889 and 1903 under threat of invasion. They were designed to defend London using the North Downs as a natural form of defence. The mobilisation centres, although referred to as forts, are more often than not just storage centres that could be defended if required. The original 'fort' is still extant within the present complex.

SOURCE: BBC News – Kent, 17 June 2011.

Fourth 'Great Escape' tunnel to be excavated, Poland

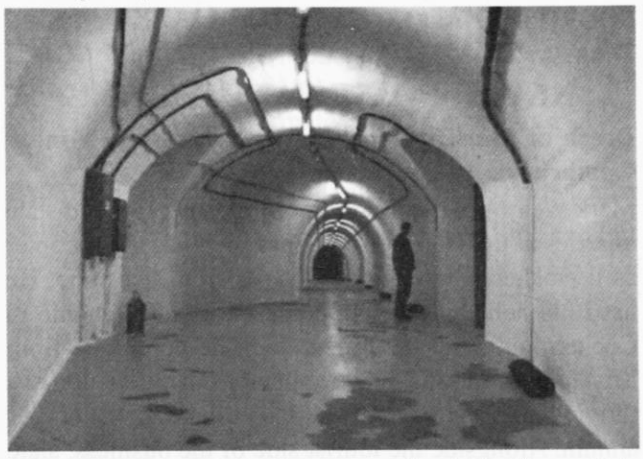
Three escape tunnels dug by British prisoners of war at the Nazi prison camp Stalag Luft III at Zagan, in what was during the war German-occupied Poland, have been more or less thoroughly investigated, and were named Tom, Dick and Harry. A fourth, George, commenced under the theatre hut, has been relatively neglected.

Former Squadron Leader Ivor Harris, now 90, operated the air pump at the entrance to George, to supply fresh air to those digging in the tunnel. He has recently revisited the site, and identified the location of the entrance to George. A team of investigators plans to excavate George in the spring of 2011. There have been suggestions that wartime artefacts and personal effects may be found in this tunnel, which was never completed before the prisoners were sent on a forced march back into Germany as the Red Army advanced; about 200 of the men died en route.

SOURCE: Alan HALL, 2011, Fourth 'Great Escape' tunnel to be excavated. *Daily Telegraph*, 19 January 2011, page 11.

Bosnia nuclear bunker transformed into art gallery

A nuclear bunker built during the Cold War for the Yugoslav President, Josip Broz Tito, has been turned into an art gallery.



The shelter was originally supposed to hide Tito and his military command in case of nuclear strike, and took 26 years and $4.5bn to complete. It is 280m (919ft) deep and 6,500 sq m (69,970) sq ft in size.

SOURCE: BBC News – Europe, 20 June 2011.

Staffordshire Cold War bunker used as art store

With the Cold War over, Staffordshire Moorlands District Council has no further need for its nuclear fallout shelter underneath its offices.

So this space - still kitted out with bunks, showers and a communications room - now stores works from the council's art collection, including *The Regatta*, by American society painter Whistler, and William Wyld's *Venice*.

Due to space constraints at its small gallery in the Nicholson Institute, Leek, many works from the council art collection are housed in this disused bunker.

SOURCE: BBC News Magazine, 23 June 2011.

Paying to relive the Cold War in Lithuania

It is now possible to enjoy (there's no accounting for taste) a three-hour 'Cold War Experience' six metres underground in a former USSR bunker 'deep in a forest' in Lithuania. There are reportedly 3,000 square metres of dimly lit tunnels and 'cave-like rooms' in this 1984-built bunker, created as an emergency base for Lithuanian State Television in the event of the USSR-controlled capital Vilnius being attacked by NATO forces. There are stand-alone heating and sewerage facilities, communication lines to Moscow, and a structure supposedly able to withstand nuclear attack.

The 'experience', designed as an educational exercise, includes paying visitors being barked at 'by canine and human alike', humiliated, interrogated, forced to sign false confessions to imagined crimes, subjected to Soviet propaganda, and instructed how to prepare for nuclear attack by the 'imperialist pigs' of the western powers.

Meanwhile, back in Vilnius, to complete your holiday in Lithuania, you can visit the Museum of Genocide Victims

in the former KGB building; and then round-off your trip with a stroll around Grutas Park, aka 'Stalin's World' which holds a massive collection of Soviet-era statues. Realistically, and somewhat surprisingly, this attraction does not include a gift shop!

SOURCE: HANCOX, Dan, 2011, Back in the USSR. *The Guardian G2*, 2 May 2011, 10 – 12.

NEWS – MINES AND MINING

Death of Mark Weir of the Honister Slate Mine, Cumbria

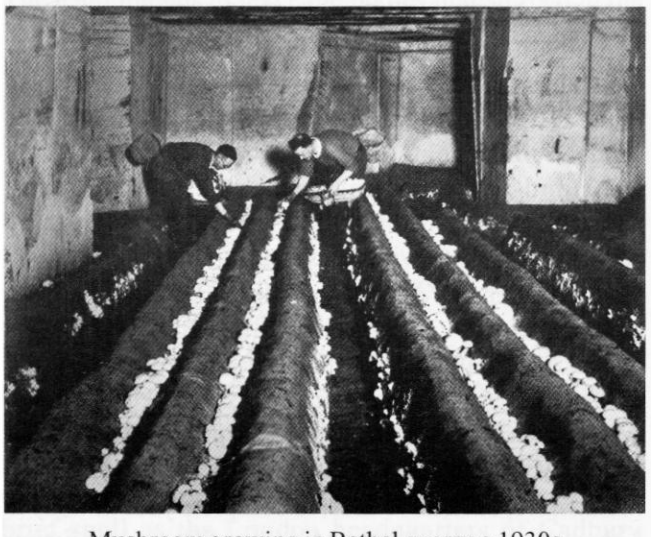
Mark Weir (45), the proprietor of the underground slate quarries at the Honister Pass, has died in his helicopter as it crashed a few hundred yards from the mine. He used his helicopter to commute between his home in Cockermouth and the mine which he purchased from McAlpines in 1985, and developed from dereliction to a thriving tourist attraction with sixty thousand visitors per annum. Alongside the tourist side of the business, slate was mined for sale.

Subterranea Britannica members who attended the Study Weekend based at Penrith a few years ago (see *Subterranea* 15, December 2007, page 23) will remember a very interesting guided tour through the active part of the mine, not to mention the white-knuckle ride in a Land Rover up the mountainside to the mine entrance, and stunning Lakeland scenery on a superbly clear and sunny day. It is understood that the mine will continue in operation and in family ownership.

SOURCE: WEIR, John Henry Mark, 2011, Obituary: Mark Weir. Entrepreneur who tapped into the tourist potential of the Lake District's slate mines. *The Guardian*, 9 April 2011, page 43 [Born 30 January 1966 / died 8 March 2011].

Bethel Quarry, Bradford on Avon, available for rent

A cave underneath a Wiltshire town which has been used for growing mushrooms for more than a century is available to rent. Bethel Quarry, a ten-acre mine beneath Bradford on Avon, has been described by estate agents as a "rare opportunity" to rent space for "unusual uses".



Mushroom growing in Bethel quarry c.1930s

Up until the end of the nineteenth century the "large and historic stone quarry" was a working quarry. But since the start of World War II it has been used for growing mushrooms. The cave has a constant temperature, humidity and a lack of light, which makes it an ideal location for a commercial mushroom farm.

Bethel's recent tenants had been moving their business to Evesham, in Worcestershire, and the site had been closed up, since September 2010.

SOURCE: BBC News – Wiltshire, 4 April 2011.

Reading's chalk mines leave legacy for home owners

People living in west Reading are facing disruption until the end of the year as safety work is carried out on disused chalk mines under their homes.

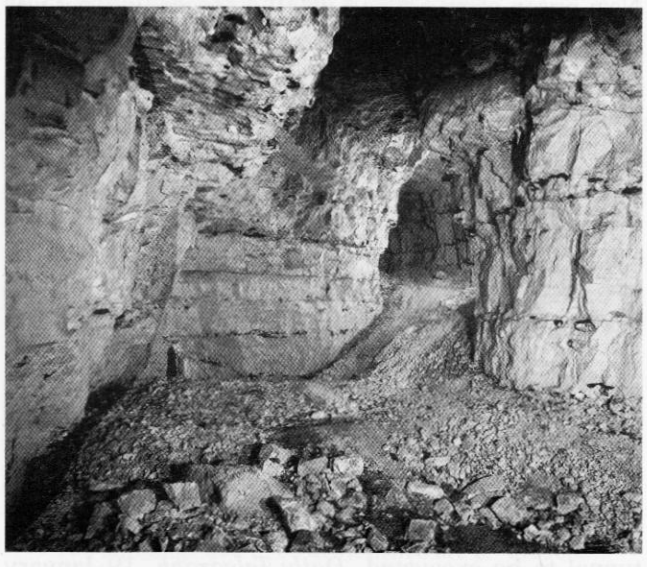
In 2000, dozens of people in the Field Road and Coley Road area were forced out of their homes when an abandoned chalk mine collapsed. A £4.3m project has been under way since the beginning of the year to stabilise the area.

The mines below Field Road were quite shallow. The roof of the mine was only 8ft below ground level and the ground had been weakening over the 150 years-plus since the mine was closed. Eventually the leakage of pipes caused the breakdown of the mine roof. Once all the the mining cavities have been found and filled, this shouldn't happen again.

Experts have said it may never be known how many chalk mines there are under Reading and its surrounding suburbs. Bricks and tiles have been made in the Reading area since the medieval period. However, it was in the nineteenth century that brick making became one of the three "Bs" in Reading, along with beer and biscuit manufacturing.

Most of the town's Georgian and Victorian buildings are built of locally-produced brick, tile and terracotta. Chalk mines would have sprung up in the countryside around Reading with no planning permission or record kept of where they were.

SOURCE: BBC News, 14 June 2011.



The Hanover mine below a residential area of Reading.
Photo Nick Catford

Shale gas mining near Blackpool, Lancashire

An American-backed firm was, in March 2011, reportedly about to commence work on a novel way to extract fossil fuel from shale at a depth of 1,000 to 4,000 metres at an onshore site near Blackpool.

The process, called shale fracking, involves pumping thousands of cubic metres of highly pressurised water mixed with sand and unspecified chemicals down to a depth of about 3,000 metres. The expectation is that the shale will be fractured sufficiently to release the shale gas, and facilitate its removal to the surface. However, concerns have been voiced about the possibility of groundwater contamination. Defenders of the scheme have said the local exploitable aquifer is at a shallower depth, of about 200–400 metres, and separated from the gas shale by impermeable rock strata.

However, disquieting evidence from the USA throws some doubt on the environmental friendliness of the technique. In Pennsylvania 1,415 gas wells have reportedly been drilled, and there are currently plans for another 2,000 this year rising to 3,500 per annum by about 2015. Water wells have been polluted, with some of the chemicals used in 'fracking' being known carcinogens. And methane gas leaks have been responsible for explosions and serious damage to property.

This contentious issue has been considered by the House of Commons Energy and Climate Change Committee, which reported on shale gas on 23 May 2011, concluding that there is 'no evidence to support the main concern – that UK water supplies would be put at risk'. The hydraulic fracturing process would not endanger aquifers 'provided the drilling well is properly constructed'. It has been contended that American experience with polluted water supplies, and even reports of Americans being able to ignite methane from their domestic water taps, are an indictment of the Bush administration's relaxation of environmental controls, not an inherent fault of fracking technology itself.

The Geological Society of London, which gave evidence before the Committee, welcomed the report. And a strong defence of fracking by Richard Selley (an authority on fossil fuels geology) has been published in the Society's magazine *Geoscientist*. Not all Fellows of the Society, however, agree. Martin Lack, a Chartered Geologist, has responded, taking the opposite view.

The British Geological Survey has estimated onshore British shale gas reserves at 150 billion cubic metres, valued at £ 28 bn. Offshore reserves are thought to be far greater, although their exploitation would be more expensive. If these are exploited, UK self-sufficiency in fossil fuels seems a possibility. However, extracting and burning all this gas can only add to the world's looming atmospheric carbon dioxide and global warming crisis.

SOURCES:

DAY, Sarah, 2011, ECC avows love for shale. *Geoscientist* 21(6), page 7.

GOLDENBERG, Suzanne, 2011, Homes blown out, tap water tainted. Life with a drilling boom. *The Guardian*, 22 April 2011, 22 – 23.

LACK, Martin, 2011, Shale gas critique 'seriously flawed'. *Geoscientist* 21(6), page 23.

NIELD, Ted, 2011, A drop to drink. *Geoscientist* 21(6), page 5.

PAIGE, Jonathan, 2011, Firm calls halt to gas drilling after earthquakes raise safety fears. Experts say fracking may have caused tremors. *The Guardian*, 1 June 2011, page 10,

SELLEY, Richard Curtis, 2011, Shale gas: blessing or curse? *Geoscientist* 21(4), 14 - 19.

WEBB, Tim, 2011, Results of 'fracking' for shale gas near Blackpool will be kept secret. Drilling method criticised for contaminating water. *The Guardian*, 2 March 2011, page 26.

Potash mining developments in East Yorkshire

The sinking of the Boulby potash mine on the Yorkshire coast south of Saltburn some twenty or thirty years ago has kept a stretch of railway line open for passengers from Middlesbrough as far as Saltburn, and for freight as far as the mine near Staithes.

A similar development further south along the same coast is now in prospect. A new mine is proposed by York Potash Ltd, between Scarborough and Whitby. Reopening a stretch of the closed (in 1965) Scarborough to Whitby line, from the new mine northwards to Whitby, is now under consideration. Potash freight trains would then continue on the still operational line via Battersby (where at present trains have to reverse) and on to Middlesbrough.

Parts of the intended route are currently frequently used by steam-hauled passenger trains of the North Yorkshire Moors Railway, so there would probably have to be some upgrading of signalling and track to cope also with heavy freight traffic. And a curve at Battersby would be required to allow potash traffic to bypass and avoid reversing at that place. Road haulage through the North Yorkshire Moors National Park has been ruled out, as probably have overland conveyor or pipeline options, on landscape and wildlife conservation grounds.

SOURCE: WILLIAMS, Alan, 2011, Potash prospects mean freight may return to Whitby. *Modern Railways* 68(751), page 15.

Tungsten mining may recommence at Hemerdon Mine, Devon

Surface buildings at Hemerdon mine, on the edge of Dartmoor, currently stand derelict, and are featured in a photograph in a recent issue of the London *Metro*. They stand, however, on what is described as the fourth largest tungsten resource in the world, and the largest outside China. Mining is expected to recommence inside two

years, and to generate £110 million revenue over ten years.

Tungsten (named from the Swedish for 'heavy stone'), aka wolfram, is a metal with an extraordinarily high density (over 19 grams per cubic centimetre, so very significantly 'heavier' than lead at 11.3) and is one of the few materials which will sink in mercury, a favourite science teachers' demonstration (the density of mercury is 13.5 on the same scale).

It has an equally extraordinarily high melting point (3,422 °C, so over twice that of iron). It is used in the filaments of incandescent electric lamps (a decreasing market in favour of more efficient lighting including now light-emitting diodes), in the manufacture of the abrasive tungsten carbide, and in alloys for armour-piercing missiles and other applications,

SOURCE: ANON, 2011, Tungsten mine on the edge of Dartmoor. *Metro*, 18 May 2011, page 47.

Radon survey in Reigate's 'caves'

Paul W. SOWAN

The Reigate 'caves' are man-made excavations into the Folkestone Sand in and around the town centre, ranging in date and purpose from the so-called 'Barons' Cave', possibly a wine cellar, under Reigate Castle (first mentioned in 1596 in William Camden's *Britannia*) to early nineteenth-century sand mines for glass-sand.

During the last year or two Professor Gavin Gillmore and his students at Kingston University, assisted by Paul Sowan and Malcolm Tadd, have been monitoring radon concentrations in the air in the Tunnel Road East 'caves'. This is not because the amount of the radioactive gas here is at anything like dangerous levels. The caves are simply a convenient and safe environment in which to train students in the use of radon monitoring techniques. The quantity of radon present would only be considered a serious hazard to health if persons lived in them permanently throughout the year.

Radon is a radioactive but chemically 'inert' gas (grouped chemically with helium, argon, neon, krypton and xenon) with (for its most important isotope Rn-222) a half-life of 3.824 days. It derives from minute traces of uranium minerals found in the Folkestone Sand, itself derived from the erosion of much older rocks such as possibly the granites of Devon and Cornwall.

An additional exercise for the students, apart from training in measuring techniques, is to attempt to correlate fluctuations in radon levels in the caves with other factors such as air temperature, air flow, humidity, and perhaps even fluctuations in the level of the water table below the cave floors.

SOURCE: GILLMORE, Gavin, Asif KHAN, Malcolm TADD, and Paul W. SOWAN, 2011, Reigate Caves, UK: a historic sand mine system – real-time radon concentration survey results and time-averaged SSNTDS. *Geophysical Research Abstracts* 13: 2pp.

Ore-lifting engine at Ecton copper mines, Staffordshire

Under Ecton Hill, on the Staffordshire fringes of the Peak District, lies the long-closed Ecton copper mine. In the mid-1780s, under the ownership of William Cavendish (the 5th Duke of Devonshire), this was one of the deepest and richest copper mines in the country, worked in a vertical chalcopyrite ore body to a depth of at least a thousand feet. As the mine was deepened, lifting ore (and presumably also pumping out water) became more and more problematic using horse-powered machinery.

In 1787 the mine agent, Cornelius Flint, and his millwright visited Cornwall to see two small Boulton & Watt stationary steam engines working at a mine. An engine was commissioned for Ecton, designed by Boulton & Watt, in 1788. This is a well-documented machine, as reported by Bill Whitehead to the Midlands Branch of the Newcomen Society at a recent meeting. Relevant archival material is now at Birmingham Central Library and in the Chatsworth Archives of the Dukes of Devonshire (in Derbyshire).

SOURCE: WHITEHEAD, Bill, 2011, The Ecton engine. *Links [Newsletter of the Newcomen Society]*,218 (June 2011), page 12.

Deaths of 52 coal miners feared in methane explosion, Pakistan

One or more methane explosions in a coal mine near Quetta, Baluchistan Province in southwestern Pakistan, on Sunday 20 March 2011, has been reported, with the likely loss of 52 lives. Twenty bodies were reported to have been recovered. The mine was operated by the state-owned Pakistan Mineral Development Corporation.

SOURCE: ANON, 2011, Likely death toll of 52 after gas blast in mine. *The Guardian*, 22 March 2011, page 25; and *Metro*, 22 March 2011, page 20.

NEWS - MISCELLANEOUS

Unexplained ground subsidence, Wokingham, Berkshire

A fifteen-feet-deep hole has appeared overnight in a garden in Rosedale Crescent, Wokingham. Dr Clive Edmonds of Peter Brett Associates (based in nearby Reading) estimates the void has a capacity as far as can be seen at present of 40 to 50 cubic metres. His firm had the contract to investigate damage to property caused by collapsing chalk mines in western Reading ten years or so ago.

The owners have sought assistance, without success, from Wokingham Borough Council and from their insurers. The Council will take no action as the subsidence is on private property. The insurers say only the house is insured. Even an investigation, never mind remediation, is likely to be costly.

Rosedale Crescent lies between the A4 trunk road and the main London to Bristol railway line, just beyond the Reading Borough Council boundary.

SOURCE: MILLWARD, David, 2011, We need someone to look into this! *Reading Post*, 1 June 2011.

Excavations for extensions below houses in London

Nadeem Aftab (47) a 'self-taught' civil engineer has been fined £100,000 for the death of his employee Arlindo Visentin (58) whilst engaged in excavating a subterranean house extension under property in Wilton Row, Knightsbridge, on 13 June 2007. The building above collapsed onto the victim.

SOURCES: BLUNDEN, Mark, 2011, 'Self-taught' engineer fined £100,000 over basement death. *Evening Standard*, 26 May 2011, page 33; and DAVIES, Lucia, *et al.*, 2011, The dangers of basement works. *Evening Standard*, 26 May 2011, page 61.

Man dies after being electrocuted in tunnel under old hospital

A man has died after being electrocuted in a labyrinth of tunnels that run beneath a derelict former mental hospital in Cornwall. Detectives are investigating the circumstances surrounding the death of the 40-year-old, believed to be a father-of-two from the Truro area.

He was found in the network of passages under the former St Lawrence's Hospital site in Bodmin at 2.20pm on Easter Monday. Another man in his 30s, who was with him at the time, was uninjured and is helping police with their inquiries.

The tunnels contain vast amounts of pipe work and wiring that carried the water, gas and electricity supply for the now abandoned hospital complex.

Police are understood to be looking into whether the pair were involved with the potential theft of copper from the area. It is believed the man was using electrical equipment at the time of his death.

SOURCE: This is Cornwall (website), 4 May 2011.

Death of man working on subterranean house extension, west London

A thirty-seven year-old building worker died when the entire ground floor of a £2m house collapsed on him while he was occupied in excavations for a basement extension in Ellerby Street, Fulham.

A representative of the Hertford-based firm responsible for the conversion has claimed that 'as far as we are concerned, all safety checks were made to the highest standard'.

SOURCE: Peter DOMINICZAK and Rob PARSONS, 2010, Builder working on basement conversion is crushed to death. *Evening Standard*, 3 December 2010, page 11.

Changes at London Railway Record

The magazine *London Railway Record*, which has reached 67 published issues since it started in 1994, is noted for its well-researched and documented historical articles, and for its wealth of vintage photographs of London railway scenes.

Its scope includes both underground and main line railways in and around London. J.E. Connor, who founded the magazine, is to step down after the October 2011 issue. Peter Kay (author of numerous published articles in the magazine) will take over as editor. Publication thereafter will be by Peter Butler Publishing.

SOURCE: CONNOR, J.E., 2011, Important announcement. *London Railway Record* 67, page 181.

Preservation of records for posterity: problems

Paul W. SOWAN

Having been active above and below ground, the length and breadth of the British Isles, and in numerous mainland European countries, since the late 1950s, I and other older members have collected a vast accumulation of now historic photographs of seldom-visited underground places and, indeed, places now impossible to visit. And equally vast accumulations of books and pamphlets.

Subscribing, as I do, to around one hundred societies I have also acquired huge numbers of magazines, from major learned journals to small-print-run newsletters of often short-lived local groups. What is to become of it all?

Preserving all this information in some permanent and accessible form compatible with modern technology is perhaps at least as important as taking hundreds or thousands of digital images of currently accessible places.

Research enquiries

Paul Sowan is, as opportunity affords, collecting data for and visiting the following classes of underground or underground-related sites, and would welcome information about any other such sites, of which some examples are cited:

[1] Long curved nineteenth-century tunnels.
Oxted tunnel (Surrey)

[2] Tunnel surveying observatory towers
Merstham tunnel surveying observatory towers (2) (Surrey)
Milford tunnel surveying observatory tower (Derbyshire)

[3] Tunnels under castles (pre-Napoleonic fortifications]
Reigate Castle (Surrey)

Communications can be sent to him via 96A Brighton Road, South Croydon, Surrey CR2 7HT.

Bulk void filling

Historically, subsurface voids perceived to be hazards to persons or property have been expensively filled by pouring concrete into them, or (as at Reigate) back-filling with sand. Such operations can lead to surface disruption and traffic congestion on account of deliveries and handling of filling materials.

However, there are alternatives. A firm called Benefil, for example, can pump 'super-lightweight filler / grout' through vertical bores to the cavities to be filled, via flexible pipes from pumps some metres distant. Filling rates of up to 60 cubic metres per hour are claimed.

SOURCE: Benefil, 2009 [Advertisement]. *New Civil Engineer*, 3 October 2009, page 2.

Beach access tunnels at Ilfracombe, Devon

The seaside resort of Ilfracombe on the north Devon coast has something for Subterranea Britannica members. Tunnels were dug by Welsh miners in the 1820s from the town to the beach, although it seems doubtful these were first created with the tourist trade in mind, so what were they for?

SOURCE: ANON, 2011, Tunnels Beaches, Ilfracombe. *The Guardian Travel*, 16 April 2011, page 14.

[**Editor's note**: For the answer, and for news of the tunnels' wartime use, see

www.devonhistorysociety.org.uk/2010/11/ilfracombe-tunnels.html

and www.tunnelsbeaches.co.uk/history.html]

NEWS – PUBLICATIONS – BOOKS

The Sand House

DETAILS: BELL, Richard, and Peter TUFFREY, 2010, *The Sand House: a Victorian marvel revisited*. Stroud: Amberley Publishing: 128 pp [ISBN 978-1-4456-0117-5].

This fascinating book is a revised and updated edition of one first published in 1988. It describes in considerable and fully illustrated detail a rock-cut house and associated tunnels excavated in Bunter Sandstone in a pit otherwise worked for building and foundry sand in the nineteenth century in Doncaster.

The house was created by excavating around a large block of in-situ sandstone twelve metres wide by 40 metres long, and then creating within this block a 'mansion' with ten rooms on two floors, complete with stables and a ballroom. Having come into the possession of the local authority at about the time of World War II, the surrounding sunken garden and sand pit were backfilled, as were the underground rooms and tunnels.

Book notice - Fullers' earth mining

Paul W. SOWAN

Fullers' earth, an unusual (highly absorbent) clay, mineralogically montmorilonite, has been worked opencast on a large scale at Nutfield and Redhill, Surrey, and also mined on and off in the same area. Not of widespread occurrence in economically exploitable quantities, it has only been extracted from deposits at a few other places, including the Maidstone district, and an area in Somerset south of Bath.

Its many uses derive from its very high absorbency, the material having a very high free surface area (about 80 square metres) per gram of earth. Thus it was good for absorbing grease from wool, and indeed, as is well-known in and around Nutfield, the natural excretory products of cats! In the warehouse at Nutfield one could see the material destined for export, in paper sacks lettered 'Good kitty' or somesuch in all the main European languages! The Nutfield pits and works are all now disused and for the most part variously landfilled or demolished.

A history of the Nutfield / Redhill mines, pits, and works is not, as far as I am aware, currently available. But a perfectly splendid book about the mining and processing in Somerset has recently been published. As the same company employed the same processes at both locations, this new work will be of considerable interest and most enlightening to east Surrey readers.

The book contains a location map (several mines and processing works were operated in and around Midford), site plans and underground plans of mines, descriptions and explanations of the properties of the clay and of its processing and uses, and is well illustrated with photographs inside the mines, at the entrances, in the works, etc. A whole chapter is devoted to associated road, canal, and railway transport. The district was served by the Somersetshire Coal Canal, the Somerset & Dorset Railway, and the Camerton Branch of the Great Western Railway.

The railways have all closed, as have the mines – the last one ceasing work in 1980. This district is also noteworthy for the residence there for some time of William Smith [1769–1839], the pioneering stratigraphical geologist. Each chapter has a very useful list of references for further reading. And there are biographical details of personnel, including James Cawley and his son Claude William Cawley, who worked fullers' earth in east Surrey. C.W. Cawley also worked a hearthstone mine at Betchworth.

DETAILS: MACMILLEN, Neil, and Mike CHAPMAN, 2009, *A history of the fuller's earth mining industry around Bath*. Witney: Black Dwarf Lightmoor Publications Ltd: 152pp [ISBN 978-1-899889-32-7] [Somerset / Nutfield (Surrey)]

[£17.50 inclusive of p&p from Black Dwarf Lightmoor Publications Ltd, 120 Farmers Close, Witney OX28 1NR].

The London Underground

DETAILS: Andrew EMMERSON, 2010, *The London Underground*. Shire Publications Ltd: 64pp [ISBN 978-0-74780-790-2].

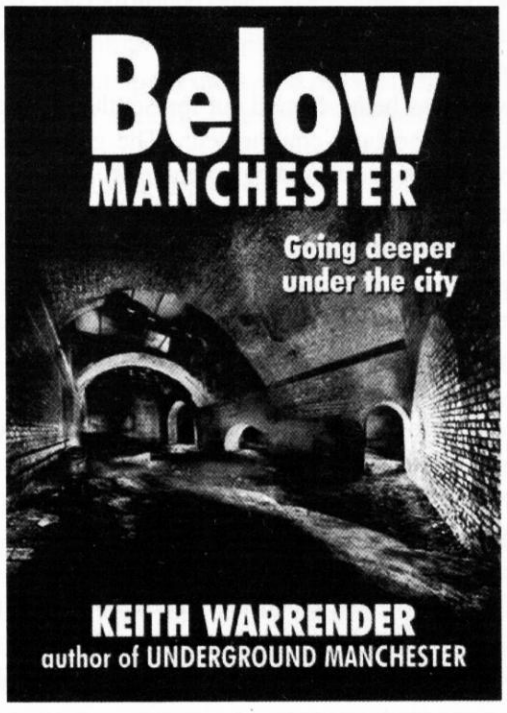
Shire Publications have generally picked eminently suitable authors for each of their numerous booklets, and this is again the case with Andrew Emmerson's short guide to London's Underground. In 64 well-illustrated pages he takes us from the world's first (steam-operated) underground railways through electrification and the development of deep tube lines to the World War II story and new lines and modern extensions. There is a useful listing at the end of the book of 'places to visit' grouped under the headings 'architectural gems', 'timewarp locations', as well as details for the London Transport Museum and its publicly visitable Depot at Acton Town. Kit yourself out with a travel card, and go and explore!

Below Manchester: going deeper under the city

DETAILS: Keith Warrender, 2009, *Below Manchester: going deeper under the city*. Altrincham: Willow Publishing: 272pp [ISBN 978-0-946361-42-7].

This substantial volume is a follow-up to the author's first book, *Underground Manchester: secrets of the city revealed*, published in or about 2008. It deals with sites not included in the first book, and sites for which further information has come to light. Substantial sections give details, illustrated with photographs and plans in many instances, for subways linking commercial premises such as the Cooperative Wholesale Society under the city's streets; voids under Manchester Victoria Station; wartime control rooms and air-raid shelters; underground (slum) habitations; and the Guardian telephone exchange. Not to mention a plethora of miscellaneous sites. The paperback volume, profusely illustrated, is on sale at the Manchester Museum of Science and Industry at £17.95.

[**Editor's note**: Looks like a useful volume to accompany Sub Brit's Study Manchester weekend, 2–4 September 2011.]



A new history of the Kent Coalfield

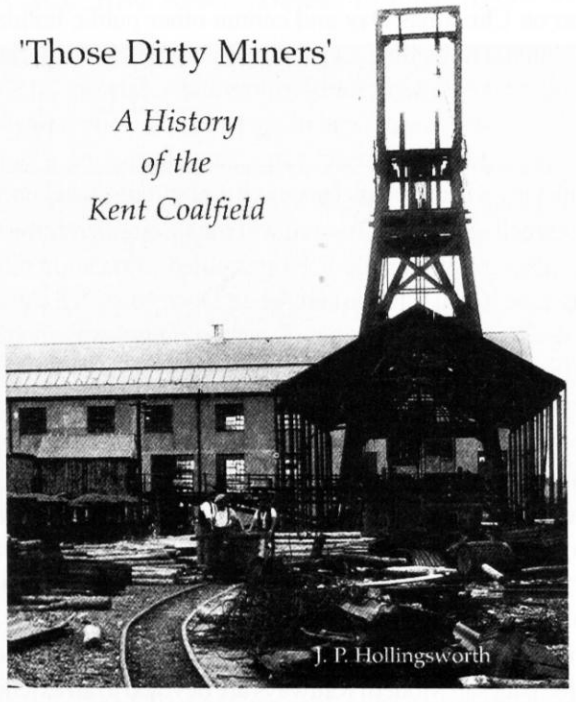
DETAILS: HOLLINGSWORTH, J.P., 2010, *'Those dirty miners': a history of the Kent coalfield. With 'Kent's last days of colliery steam' text and photographs by Tom Heavyside*. Catrine: Stenlake Publishing Ltd: 96pp [ISBN 978-1-8403308-8]

From the first discovery of coal at a depth of 1,100 feet in a borehole near Dover in February 1890, to the closure of the last of the four producing mines in Kent in 1989, is almost a century of history interestingly set out in this new book.

It was ten or twenty years or so after the 1890 discovery that commercially saleable coal was raised. The Dover Colliery, at the Folkestone end of Shakespeare's Cliff, reputedly burned more coal in running its engines and pumps than it ever raised to the surface (the thickest of the 14 seams proved in 1,173 feet of Coal Measures was a mere four feet).

Hollingsworth's new book presents a wealth of illustrations and supporting text for the failed mines, as well as for the four that did ultimately succeed (Tilmanstone, 1906–1986; Snowdown 1908–1987; Chislet 1914–1969; and Betteshanger 1924–1989). Boreholes and shafts at Adisham, Fredville, Goodnestone, Guilford, Maydensole, Wingham and Woodnesborough all absorbed capital with no return. The small lignite mine at Cobham, working geologically younger seams from much shallower depths up to 1953, is also featured.

The East Kent Light Railway, and the producing mines' internal lines and locomotives, are also described and illustrated, as is the aerial ropeway from Tilmanstone which passed through twin tunnels through the cliffs to a huge bunker at Dover Eastern Docks. And information is included concerning the roles of Arthur Burr, Richard Tilden Smith, and the unions in the story.



NEWS – TUNNELS AND TUNNELLING

Progress with new subsurface stations and tunnelling for Crossrail, London

The July 2011 edition of *Modern Railways* contains a substantial and detailed progress report on Crossrail, London's east-west mainline loading gauge railway in tunnels to be driven through the centre of the city between Paddington and east and southeast London.

New subsurface interchange stations are under construction at Paddington, Bond Street, Tottenham Court Road, Farringdon, Liverpool Street and Whitechapel.

Although some access and / or working shafts have already been sunk, serious tunnelling to link these stations together is due to start between April and June 2012.

The tunnel drives, totalling 20.6 kilometres of double-bore tunnelling and including new tunnelling under the Thames, will be as follows:

From	To	Length km	Start	Finish	TBMs
Royal Oak	Farringdon	6.1	2012	2013	Two EPB
Limmo peninsula	Farringdon	8.3	2012	2014	Two EPB
Stepney Green	Pudding Mill Lane	2.7	2013	2014	Two EPB
Limmo peninsula	Victoria Dock	0.9	2014	2014	One or two EPB
Plumstead	North Woolwich	2.6	2012	2014	Slurry TBM with separate cutter heads for two drives

TBM = tunnel-boring machine
EPB = earth pressure balance

There being currently no TBM manufacturers in Britain, the machines costing up to £15m each are being made by the German firm Herrenknecht at Schwanau near Strasbourg. The machines are up to 120 metres long, and weigh up to 850 tonnes. They will be at work non-stop other than on Christmas Day and certain other public holidays. Additional tunnelling and shaft-sinking will be required of course at the stations, for corridors and escalators. At some stations at the western end of the route, the main tunnelling will precede local corridor tunnelling; further east, station tunnelling will be completed before the running tunnels arrive.

One small section of Crossrail will run through a refurbished existing pair of tunnels. The brick-lined Connaught tunnel under the Royal Victoria and Albert Docks between Custom House Station and the new Thames tunnel was made in 1878, and was last in use by passenger trains on the North Woolwich line in December 2006.

Original 1870s engineering documents suggest the existence alongside of now lost service tunnels, the whereabouts and current state of which will have to be ascertained. They may not even have been made – nobody knows for sure. If they do exist, they could be open, backfilled with earth, or flooded and, if flooded, a significant hazard in modern work.

This will not be the UK's first search for suspected tunnels!

Three pages in Modern Railways are devoted to an extended illustrated account of the Connaught tunnel (around 100 metres of bored tunnel with cut-and-cover approaches) and how the two bores are to be enlarged to accommodate Crossrail infrastructure. This includes photographs of the tunnel interior, and of the surface ends of ventilation shafts.

The eight or nine tunnel-boring machines for the entire Crossrail project should have completed their drives by 2014, after which work will commence on track-laying, installing signalling equipment, completing and fitting-out stations and so forth.

SOURCE: HARVEY, Dan, *et al*,. 2011, Crossrail: a new railway for London. *Modern Railways* 68 (754), 39 – 69.

Smugglers' tunnel is discovered by workmen in Hastings

Work on a flood protection scheme has unearthed a twenty metre-long hand-built smugglers cave.

A team from Southern Water made the unusual discovery while digging trenches. Work was immediately stopped and archaeology experts were called in and confirmed the find was likely to be a smugglers' tunnel built in the early eighteenth century and used to smuggle goods such as tea, tobacco, alcohol, silk and sugar.

The work was being carried out for Southern Water by a contractor who later commented: "The ground literally collapsed while we were digging on grass.

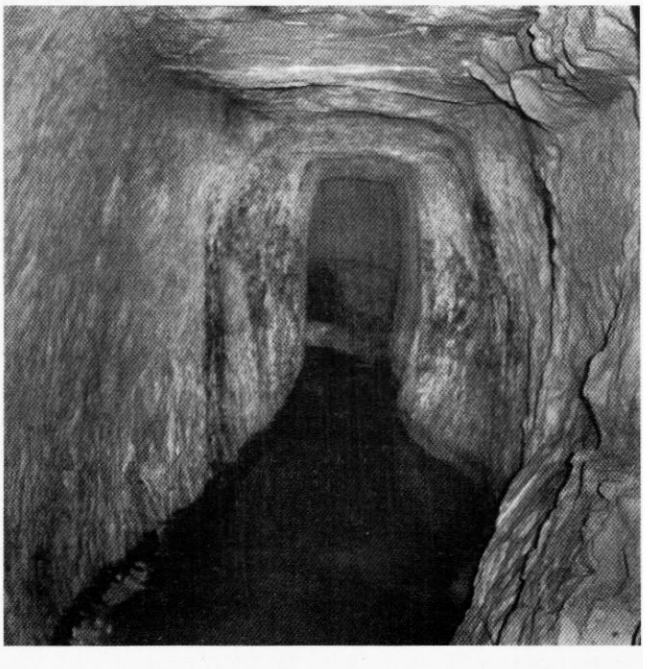
At first we thought it was a natural void but we had a look down, and noticed a big hole that went off in both directions."

At the request of Hastings Borough Council the entrance to the tunnel was blocked off, but the tunnel itself has been left open so archaeologists could have access to carry out further study.

The tunnel has been interpreted as a previously unrecorded smugglers' tunnel, which are reasonably common in Hastings, with several being found or mentioned in local folklore throughout the town.

There is a large section of these tunnels open to the public at St Clement's Caves, which are situated around 300 metres to the south of the site.

SOURCE: *Hastings and St Leonards Observer,* 6 April 2011.



Peak District rail tunnels reopen for cyclists

Four former railway tunnels which have been closed since the demise of the Midland Railway in 1968 were reopened in May to cyclists.

The tunnels have been refurbished in a £2.25m project funded by the Department for Transport and were officially opened by transport Minister Norman Baker on May 25. They form part of the Peak District National Park Authority's existing Monsal Trail, which links Blackwell Mill and Bakewell.

Work started to reopen the tunnels and improve the surface of the Monsal Trail in December 2009 and was completed in early May as part of the Pedal Peak District project. Two shorter tunnels on the route – Chee Tor number two and Rusher Cutting – already formed part of the trail. But the other four – Headstone Tunnel, Cressbrook Tunnel, Litton Tunnel, and Chee Tor Tunnel number one – could not be used for safety reasons, with public footpaths taking people around them.

A Peak District spokesman said the idea of the project was to "create a traffic-free route into and through the national park and make cycling a realistic, healthy alternative to using the car for work and leisure".

He added: "The tunnels help create one of the most spectacular trails in the country offering cyclists, walkers and horse riders stunning views of the Peak District National Park not seen for more than forty years.

"The public can now experience the full length of the former railway route at their own pace and see breathtaking views at places like Water-cum-Jolly Dale that have remained hidden since the railway closed."

The next stage of the plan is to create a circular route linking to Matlock. Just clearing the tunnels cost £20,000 while surveys cost £40,000 and access ramps a total of £60,000. Specialist repairs to make the tunnels safe cost £360,000, resurfacing £400,000 and lighting £600,000.

SOURCE: *Yorkshire Post,* 13 May 2011.

Litton Tunnel

Work is under way on a new cycle path between Plymouth and Tavistock, Devon

The 17-mile (26km) route will follow an old Great Western Railway branch line through a tunnel at Grenofen built by Isambard Kingdom Brunel. It will also include a £2m, 1,000ft (305m) long viaduct across the Walkham valley, which is currently being built.

The full route, which will form part of the *Drake's Trail* walking and cycling network, was expected to open in Spring 2012, project managers said.

The Grenofen tunnel, bought by Devon County Council for £1, was built in 1859 for Great Western trains. It closed to services about fifty years ago.

Project manager Graham Cornish said its being part of the route would give the tunnel a new lease of life. He said: "Most of the stone work is in pretty good condition. The tunnel is an absolutely critical missing link in this."

The trail is being provided by Devon County Council, with funding from the European Union and the South West Regional Development Agency. West Devon Borough Council and the Devon Renaissance regeneration company are also involved with the project.

SOURCE: BBC News – Devon, 19 June 2011.

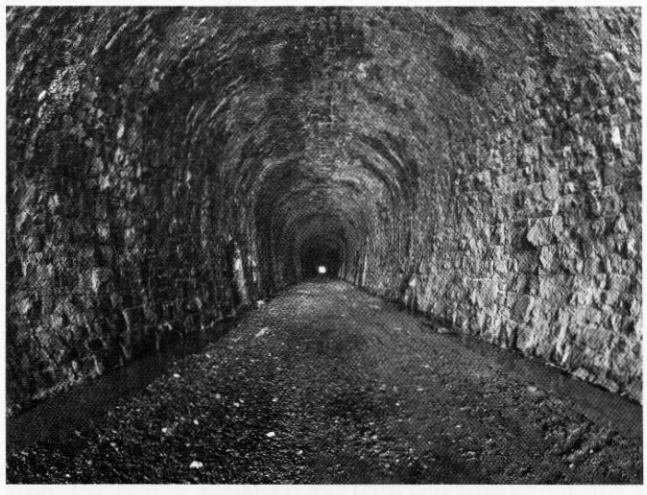


Photo Nick Aldous

New Crossrail / Thameslink station at Farringdon, London

The north–south passenger railway across London is, with the completion of Crossrail, to be complemented by an east–west route. London, like many major cities, has radial rail routes with termini on the periphery of the city-centre area, meaning awkward bus, metro, tram or taxi rides across town for journeys such as Dover to Nottingham.

Brussels linked its North and South terminals with a subsurface cross-city link in the 1950s, so trains from Lille or from the Belgian coast can now run straight through to Amsterdam or Köln, serving a central station as well as the two former termini. Paris more recently built fast deep-level lines below the existing metro system.

London's proposed deep-level fast lines under the Central and Northern lines were never developed beyond deep air-raid-shelter tunnels below some existing tube stations (the plan would have been to join all the shelters up with running lines).

Now, London is catching up. Passenger services between London Bridge and King's Cross St Pancras were reinstated in the 1990s, on an almost forgotten tunnelled route reserved for decades for freight traffic: this reopened passenger route is called Thameslink. Now we are to have Crossrail, running from Paddington to Liverpool Street, and beyond at each end.

The two cross-London lines will pass one above the other at Farringdon, which currently serves Thameslink and some London Underground services. And this is where London's first 'central' station will be built, providing for interchange between the two lines.

Thirteen buildings have already been demolished to make way for the new Farringdon Station, on the opposite side of Cowcross Street from the existing station. This new station will open for Thameslink trains in December 2011. Tunnelling machines from Royal Oak and Docklands will meet at Farringdon, with the new station serving trains on both lines by 2018.

SOURCE: ANON, 2011, Where Crossrail meets Thameslink. *Railwatch* 127, page 20.

Crossrail Station at Woolwich Arsenal

Whereas work is under way on new Crossrail stations in London, at Bond Street, Tottenham Court Road, and Farringdon, progress is slower at Woolwich. Funding has now been secured for the construction (but not yet the fitting-out) of the new 'station box' at the southeast London suburb. It is hoped this structure will be completed by the time the first tunnel-boring machine reaches the site in late summer 2013.

SOURCE; HARVEY, Dan, 2011, Crossrail update: breakthrough at Woolwich. *Modern Railways* 68(751), page 114.

Camden Railway Heritage Trust

The former Camden Goods Depot site developed from the opening of the Regent's Canal in 1816 and the London & Birmingham Railway in 1837. An excellent new website www.crht1837.org provides historical background and presents surface and subterranean heritage features including locomotive and goods storage sheds, stables, vaults and tunnels.

SOURCE: ANON, 2011, Camden Railway Heritage Trust launches website. *Greater London Industrial Archaeology Society Newsletter* 253, page 5.

[**Editor's note**: Peter Darley, the founder of CRHT, gave an illustrated talk to members at the Sub Brit Spring Conference in London in April 2009. See also *Subterranea* 20 (September 2009), pp19–28.]

Flood alleviation tunnel opened in Bristol

Bristol's 'oldest and best-loved buildings' are now safe from flooding after completion in 2008 of a new 805-metres storm relief sewer under the historic city centre. The new tunnel runs from Frogmore Street to Woodlands Avenue. Blasted through 18,000 tonnes of 'the second strongest rock in the UK', the sewer was initially driven by drilling and blasting to a rectangular profile, three and a half metres by three metres. Around five hundred controlled explosions were needed below the city streets. Six enlarged turning bays at 150 metre intervals was provided to facilitate spoil removal. The completed sewer is of circular cross-section, concrete lined, with a diameter of 2.2 metres.

SOURCE: ANON, 2008, Under control. *New Civil Engineer*, 8 October 2010, page 32.

Modernisation of the Subway, Glasgow

The Glasgow Subway is to be modernised. Scotland's Finance Minister is authorising a substantial capital contribution to the Strathclyde Partnership for Transport's plans for new trains, upgraded signalling, refurbished stations, improved accessibility and smart-card ticketing.

The Glasgow Subway, or Metro, is a single-bore double-track railway operated as a simple circular route, with half the trains running clockwise, the others running the other way round. The line has fifteen stations, and passes under the River Clyde at two points, between the St Enoch and Bridge Street stations to the east, and between Govan and Partick in the west.

There are sidings into the Broomloan Depot between Ibrox and Govan. Unlike the London Underground, no stations are directly linked to mainline termini (since Buchanan Street and St Enoch main line stations closed), although St Enoch subway station is close to Glasgow Central, and Buchanan Street subway station has a travelator connection to Queen Street. The only surface station building of any note is the Scottish Baronial-style St Enoch Station.

SOURCE: ANON, 2011, Funds for Glasgow Subway upgrade. *Modern Railways*, 68(751), page 7.

Drakelow

As many readers will know, the huge underground Drakelow complex in Worcestershire was built as a shadow factory in World War II and saw subsequent reuse as both a Regional Seat of Government and an RGHQ. When the UK Site Directory (enclosed with the last edition of *Subterranea*) was being compiled, access to Drakelow was severely limited.

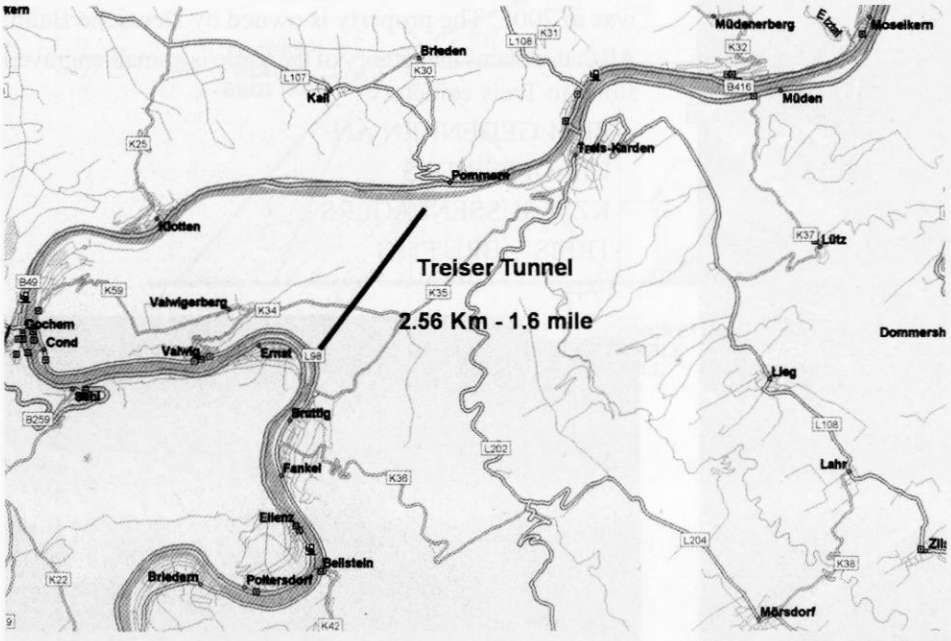
Since then, Sub Brit members Chris Wilkins and Michael Scott have put in many hours of work to help preserve the site and have negotiated new access arrangements with the owner. Many Sub Brit members experienced their work first-hand in last year's visits. For more details see the website at www.drakelow-tunnels.co.uk

Congratulations to Chris and Michael for their hard work and helping to secure an important WWII and Cold War monument.

The Treiser Railway Tunnel, Germany – Past & Present

by Peter Jigins

The present-day Mosel railway route Koblenz – Cochem – Trier, containing the Treiser Tunnel (aka Valwigerberg Tunnel), is situated on the north side of the River Mosel, apart from a short section near Bullay which is on the south side.



Ceremony at the north portal on 20 December 1919 to mark the breakthrough of the tunnelling

Ceremony at the south portal on 20 December 1919 to mark the breakthrough of the tunneling

History

During WWI Germany decided, for strategic reasons, to build a railway line that would bypass Cochem. The new line would connect to the current main line at Treis-Karden, cross over the Mosel, then via a tunnel pass through the hillside (Treiser tunnel – Treis to Bruttig), continue on the south side of the Mosel, eventually rejoining the main line at Bullay.

Construction commenced in 1916; the 2.56 km Treiser tunnel was built on the south side, together with a viaduct through the centre of Bruttig. The Treaty of Versailles (1923), and other matters, prevented the project from being completed and eventually the tunnel was used for growing mushrooms.

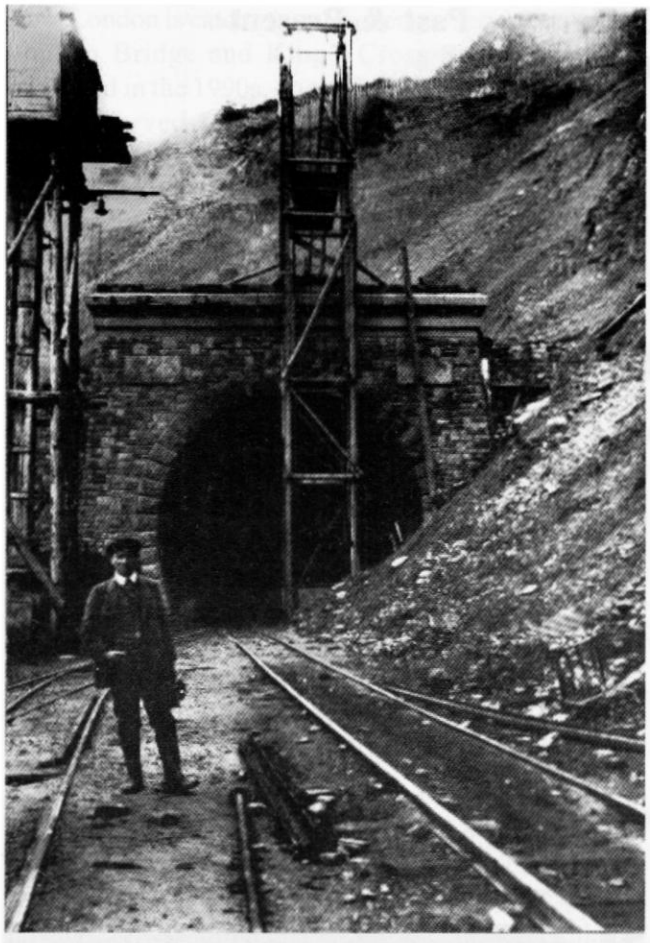
World War II

In March 1944, Germany was in need of underground locations for factories for war production, and it was therefore decided to use this tunnel. A concentration camp (Cochem – subcamps Treis/Bruttig) was constructed in the vicinity, which was a satellite camp of the main Natzweiler camp in eastern France.

On 10 March the first three hundred French prisoners were transported from Natzweiler to Cochem by train, then over the river to the camp at Bruttig. There they worked on construction of the factory in the tunnel. On 6 April a further seven hundred Russian and Polish prisoners arrived but many never survived the short stay there.

A major part of the tunnel (two-thirds) incorporated an upper floor, used as offices and accessed by stairs. There was also a grocery store, a large kitchen, several dining rooms, bathrooms, laundry rooms – and jobs for up to (planned) two thousand people. Electricity, light, ventilation, running water from its own water plant, a steam power station, restrooms and a biological waste-water treatment plant were also provided. Total working space amounted to 30,000 square metres. The tunnel is dead straight with only slight curves in the portal areas.

Entrance protection to the underground factory was provided by a heavy door of reinforced concrete capable of rolling into a chamber cut out in the tunnel. The door was 3 metres thick and 7 metres high. The factory was used by Bosch (code name WIDU GmbH) and

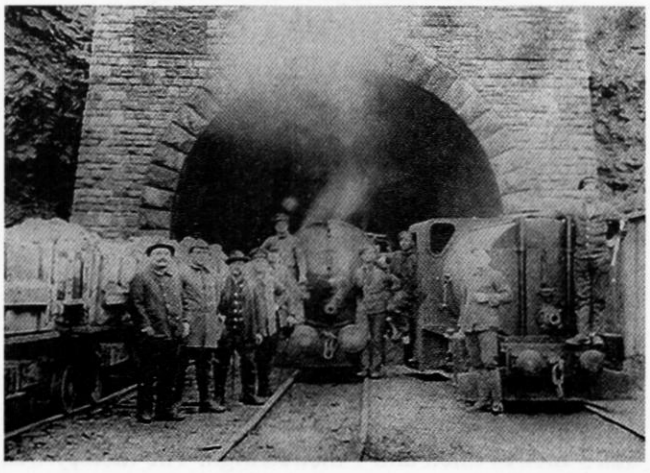


South portal before the retaining wall was built
(see picture below)

production of aircraft parts began in June, although problems were encountered due to high humidity.

Two bunkered water production plants were built adjacent to the Bruttig tunnel entrance; the lower one, near the Mosel, contained the pump system and the upper the water reservoir. Both were later damaged by explosions but are still visible today.

On 14 September 1944, due to the deteriorating war situation, six hundred prisoners were conveyed to Cochem station, for eventual transportation to Nordhausen concentration camp. Ten to fifteen Bosch workers remained on site until January 1945.



North Portal in 1922

After taking over the region in the summer of 1946, French troops demolished several places inside the tunnel and also the tunnel portals. There is little to show where the north portal was, the area now being a nature reserve. The location of the south portal is shown by the remains of the retaining wall which led to this tunnel entrance. The central 195m ventilation shaft has now been capped with concrete, and the last official inspection was in 2007. The property is owned by Deutsche Bahn.

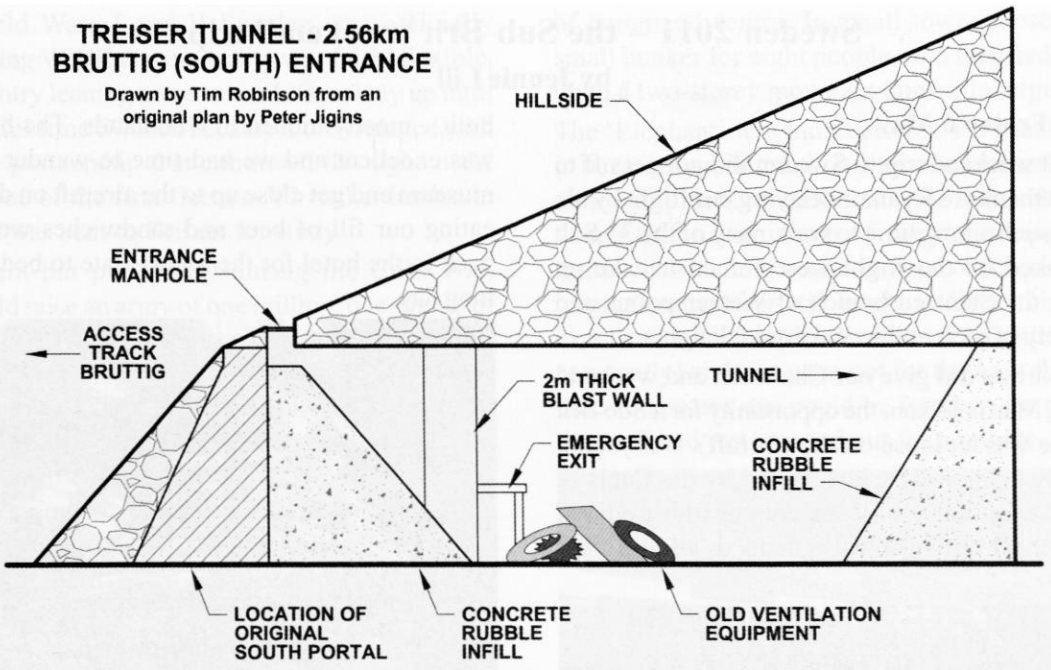
All that remains in memory of the camp is a small engraved stone in Treis cemetery.

ZUM GEDENKEN AN
DIE OPFER DES
KZ – AUSSENLAGERS
TREIS – BRUTTIG
1944

Simulated view of the Bruttig (south) portal
in March 2011. Photo by Peter Jigins

Present Day – Visit on 20/25 June 2011 – Bruttig

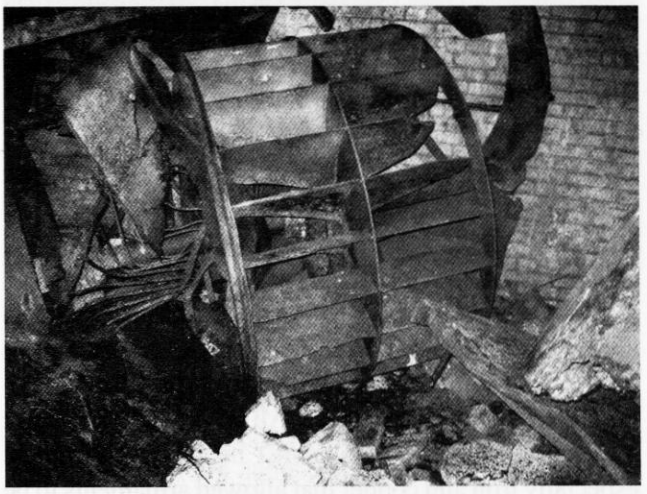
Access to the tunnel for routine inspection was provided by a locked and secured manhole. Today the hinges are broken and the green cover plate just rests over the 60cm-square hole. This access is situated just to the rear of where the tunnel portal would have been, and in the centre of the tunnel roof.



Removal of the cover reveals a hole approximately 1.8 metre in depth. From the bottom of the hole there is a short horizontal passage which leads to the start of the infill slope (concrete rubble) which in turn leads to the floor of the tunnel. Part of the way is blocked by a two-metre thick 'blast protection wall' but this has an opening in the right-hand corner allowing access to the main tunnel.

Immediately behind this wall is another small reinforced concrete tunnel, which begins in a 'Z' shape and which was the emergency exit onto the Mosel riverside. It was originally about 20 metres long and was also used for supplying the fresh air ventilation system. Holes in the concrete floor lead to what appears to be the piped sewerage system and two large holes in the right-hand wall reveal another brick wall about a metre outside the tunnel.

The first part of the tunnel is littered with the remains of the rusting old ventilation plant and care needs to be taken navigating this. This tunnel section is approximately 80m long, the length being determined by the next infill



Ventilation fan. Photo by Peter Jigins

Roof collapse at the far end of the tunnel. Only 80m of tunnel is now accessible. Photo by Peter Jigins

mound/roof collapse. Photography is difficult with a normal camera due to size of the tunnel and its dark colour.

Location

Bruttig portal – Lat: 50 8' 43", Long: 7 14' 14'

Ventilation shaft – Lat: 50 9' 29", Long: 7 14' 33'

Treis portal – Lat: 50 10' 1", Long: 7 14' 53"

Bruttig Viaduct

From the tunnel, the track bed continues for just under a kilometre before entering the town of Bruttig. The north section of the town being on relatively low ground results in the track entering the town on a level with the roofs of the houses.

This necessitated the building of a viaduct for the track, through the centre of the town. Stone excavated from the tunnel was used to construct the viaduct, parts of which are up to 10m high. It is still present today and, although the track bed is in a poor state of repair, it is possible to walk along the length of it.

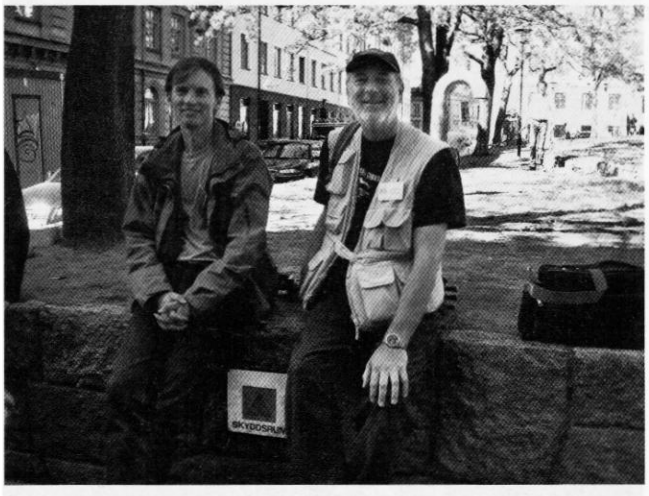
Sweden 2011 – the Sub Brit 'weekend' trip

by Jennie Lill

Day One – Friday 6 May

The Sub Brit weekend trip to Sweden did not get off to the best start thanks to Ryanair delaying our flight by six hours. With such a long time to wait many of the 33 Sub Britters booked on the flight were forced to take up residence in the Stansted branch of Wetherspoons and enjoy a variety of their edible and liquid delights.

Our late departure did give our Chairman and weekend co-organiser, Martin Dixon, the opportunity for a Sub Brit first when he was let loose on the aircraft's PA system. After initially being rudely interrupted by the Captain, Martin was eventually able to convey the updated program for that evening and also thank us all for flying Ryanair!



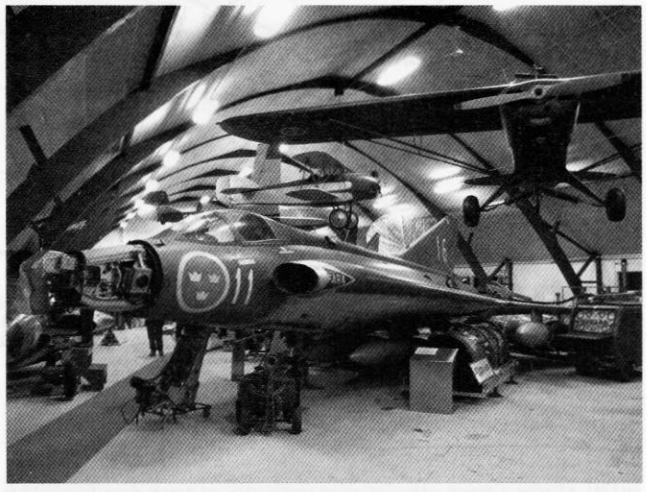
Lars and Martin with the shelter sign above the Katarinaberget shelter. At this time Lars had difficulties proving his information that one of the major pedestrian entrances is beneath the grass just behind.

Photo Linda Bartlett

Skavsta Aircraft Museum

On arrival at Skavsta airport we were met by Lars 'Top Swede' Hansson and the three other members who had travelled by alternative means – this made 37 of us in total for the trip. A short walk across the road from the airport was our hotel for the night in Skavsta. Once we had our room keys and had dropped our bags we headed back out. The original program was to have been a late afternoon tour of Femore fortress and coastal artillery battery followed by a buffet supper on site. Due to our delay the visit had to be postponed and Lars had managed to rearrange the buffet supper and persuade the nearby airport F11 Aircraft Museum to open specially for us – so an extra site for the weekend!

The museum was fascinating and included information about the Swedish air force which during the early 1960s was the third largest in the world after the US and USSR. To cope with the huge number of aeroplanes, six mountain hangars were made, with over one hundred runways being built – mostly hidden in woodlands. The buffet supper was excellent and we had time to wander through the museum and get close up to the aircraft on display. After eating our fill of beer and sandwiches we meandered back to the hotel for the night – late to bed after a very long day.



F11 air wing museum with a SAAB S35 Draken in the foreground. Photo Clive Penfold

Day Two – Saturday 7 May

An early breakfast in the hotel was quickly followed by check-out and departure by coach to Stockholm. Driving through the Swedish countryside Lars kept trying to interrupt our napping with information on Sweden's history, especially the Cold War period (see panel).

Sweden's Political History

During the seventeenth and eighteenth centuries Sweden was the major superpower around the Baltic Sea with 'mother Russia' always present as the main protagonist. Sweden had provinces in northern Germany, and dominated all the Baltic countries as well as the whole of Finland. During the seventeenth century Sweden's armies fought to keep the Catholics out of northern Europe and King Gustav II Adolf was killed at Lutzen, Germany in 1632. Four years earlier his flagship *Vasa* sank on her maiden voyage. She was located and brought to the surface only fifty years ago and is now housed in the most popular museum in Sweden.

In 1718 the next king, Charles XII, died in Norway and the superpower trembled. Sweden was attacked at this time not only by Russia but also by Denmark, Norway and Germany. In 1719 Russian naval forces were even occupying many Swedish towns. In 1809 Russia attacked Sweden again, this time up north by marching on the ice across the Baltic Sea. At this time Sweden lost control of Finland and new borders were set which have remained the same ever since. All these wars would not have been possible if it hadn't been for the mines, especially iron and copper that allowed armaments to be produced inside Sweden throughout this period.

During World Wars I and II Sweden was officially neutral. During WWII this neutrality was fairly flexible, with the country leaning more towards Germany up until 1943. After this time Sweden became more engaged with the Allies, a partnership that continued throughout the Cold War. One of the first German V2 rocket landed in Sweden and was sent to Britain for study.

Neutral again but pro-NATO during the Cold War, Sweden could raise an army of one million, one-eighth of the population at that time. For coastal defence the large Swedish Navy had ships up to destroyer class and a vast number of submarines and torpedo boats. These could easily hide in the dense archipelago and also in the huge Muskö mountain dockyard. During WWII the coastal artillery had around one hundred batteries mostly on the east coast. Some of these were transferred into NBC-proof batteries but forty new batteries were also constructed during the Cold War with artillery between 7.5 and 12 cm. The 12 cm m/70 (Bofors 1970 model gun and battery system) became the last fixed coastal artillery system constructed anywhere in the world.

Sollentuna 'The Elephant': Civil defence command central for northern Stockholm

After ninety minutes in the coach we arrived at our first underground site and walked up to the entrance in the surrounding woods. Having entered the bunker through the middle door (there are three entrances / exits) we were then locked in to stop any passers-by from exploring with us. We proceeded up to the big 'order room' for an introduction to the site from Lars and members of the Swedish Fortification Society. This took us right back to the 1970s (for those that could remember) – an office type room, with bright orange fixtures and fittings and a very dated look.

Main entrance to the Elephant. Two other doors are available; one is the emergency exit and the other is for ventilation. Photo Clive Penfold

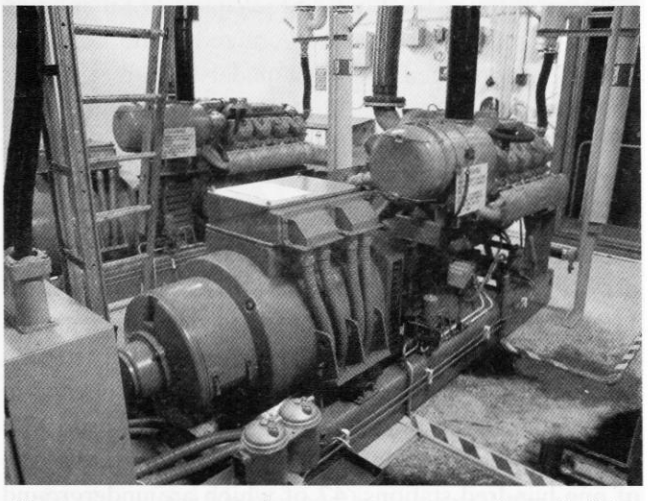
Together with the 'Wolf' in southern Stockholm, the 'Elephant' (for the north) is the largest and most modern of all Swedish civil defence command centres. In every community in Sweden (approx 250) there was some kind of command centre. In small towns these could be a small bunker for eight people, or a fortified cellar, right up to a two-storey mountain bunker in larger cities.

The 'Elephant' was built between 1972 and 1977 when it became operational. It remained in use until 2000 although practices and tests were stopped in the mid-90s. At that time some of the radio equipment was removed but there remains approx 95 percent of the original equipment still in place. Everything is still in excellent condition (thanks to the dehumidifiers running constantly) and if it were not for the now slightly out of date equipment one could be forgiven for thinking that the staff had just stepped out for a minute.

Main operations room; there is also a smaller operations area adjacent to this room. Photo Clive Penfold

Exploring the 1970s bunker

The bunker is a fully NBC-proof site built into the mountain and sitting under 30-40 metres of granite. It consists of three steel shell structures complete with blast doors, standing on shock absorbers. Container 'A' is the main building consisting of two floors and containing command central. Container 'B' houses the dormitories over two floors for the 80–90 men/women who served at the site. Container 'E' (for energy / electricity) is for



The two generators are in a separate room at the end of the main access tunnel but outside the main gas-proofed sections of the bunker. Photo Clive Penfold

the generator and overpressure and filters for the clean air. The site could be self-sufficient in water, power, food and air for at least ten days.

We were allowed free run of the place, so we all set off in different directions to explore every nook and cranny. As we bumped into people going the other way, we'd say 'have you seen the .....' and off we'd go again. It was a tremendous chance to see the site in depth (!).

The bunker could control the fire department, home guard, and civil defence personnel for northern Stockholm. This allowed for centralised deployment of essential services across Stockholm to help with any required evacuation, assessing and transporting the wounded and also the dead. It also coordinated radio information from ROC stations, which included wind direction for monitoring the movement of radioactive clouds. The alarm system is still in place and checked every three months although much to everyone's disappointment we were unable to test this, as it is no longer controlled from the bunker. There is also a set of lights on the wall to indicate the amount of protection within the site. Red is the highest being the air raid, which would lock the whole site. Orange was for radioactive and green for gas.

After we'd finished our exploration of the bunker, we had a sandwich lunch outside in the sunshine – thanks to Martin and Lars for organising this. After our refreshments we set off on the coach to the hotel in Stockholm.

Stockholm Metro ('T-bahn')

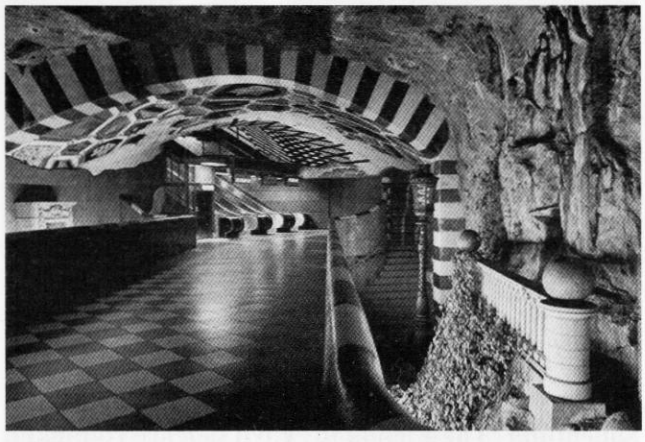
After dropping off our luggage at the hotel we were on the road again, this time to the local metro station Fridhemsplan. This is a deep and large station at a junction of two of the three lines. The deepest of its platforms sits approx 30m below street level. Looking at the T-bahn stations was part of the plan of site visits for the weekend. After collecting our 3-day metro passes at the station we then took the train to Hotorget station.

A short walk from this station bought us to Hotorgshallen, a subterranean market hall in the centre of Stockholm. When the city centre was modernized in the 1950s the hall was submerged one floor under the street. It was reopened in 1958. A second underground level holds fridges and store rooms for the market – some of our members could be seen sneaking off to have an illicit look round.

After a short wander around the market it was back on the metro to explore further. The Stockholm system is 110 km in length with seven lines divided into three groups identified by the colours blue, green and red. The green line is the oldest with the first section being opened in October 1950. The red line was opened next (April 1964) and finally the blue line in August 1975. There are a total of one hundred stations, 47 of which are underground and built in rock or concrete. There is also one 'ghost' station – Kymlinge – that was never put into public use.

T-bahn shelters

As many of the metro stations have platforms that sit between 20m and 30m below street level they made an idea site for bomb shelters. These are usually located in the middle section between the parallel platforms and some are even double height. During the Cold War these were available to civilians to use and the train driver would have been responsible for ensuring that everyone got into the shelter.



Architecture in one of the sections of the Kungsträdgården underground station.

Unfortunately it is not possible to view them now as they are used as staff rooms for drivers, store rooms and so on. Odenplan is such a station with this type of platform shelter and also an entrance below to more shelters under the tracks. Many of the stations have large sections showing the unlined granite rock some of which has been decorated in unusual ways. Art and decoration appear to be quite a large part of the Stockholm metro system as is evident at one of the deepest stations, Kungsträdgården, at the end of the blue line.

One of the more entertaining features of the metro is the little funicular railways that run alongside the escalators. These are an effective way of providing disabled access without boring new lift shafts. At one station this allowed Sub Brit to attempt to beat the world record for the

Could this be a world record for the number of people squeezed into one of the elevators that are used on many stations in parallel to the escalators.
Photo Chris Rayner

Swedish lift squeeze – we must have looked like six-year olds as we managed to fit about twelve of us into one little car.

During the afternoon there was also time for a walk around part of the old city (Gamla Stan) with its many churches and fine architecture.

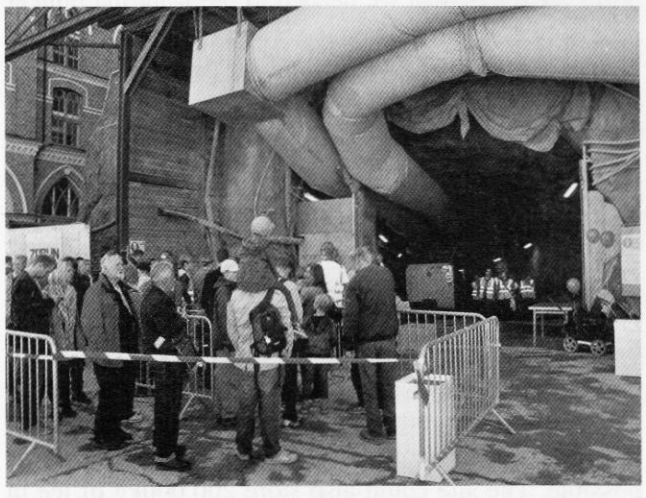
Once we were exhausted we found our way back to the hotel for a rest before dinner, conveniently at the hotel so we didn't have to do any more walking. The menu consisted of lobster soup followed by duck with potatoes. It was a great meal (well chosen by Lars and Linda). Poor Linda had to cope with nine 'fussy eaters' and their differing menu requirements – but the chef did a really good job. Needless to say there was a lot of further chatting over a beer or two ...

Day Three – Sunday 8 May – Hotel Bunker

On Sunday morning after breakfast in the hotel we had a very short walk to our first site (another extra) – the hotel's underground garage! Within Sweden all bunkers are marked "Skyddsrum", meaning a Safe Room, on a square orange sign with a blue triangle. There were sufficient bunkers built in Sweden during the Cold War to house *all* Swedes, unlike other countries (including the UK) which often provided shelter only for those personnel deemed essential. Blocks of flats, offices and other large buildings all had their own shelters meaning that the "Skyddsrum" signs can be seen all over the city.

The hotel's garage still has signs of its previous purpose with the gas-proof blast doors. The bunker could accommodate somewhere between 300 and 500 people. Previously the building had been an office block and was later converted into a hotel.

On the way to our first main site we stopped at Morby Centrum station – located at the end of the red line – as it houses one of the shelters between the platforms. We tried to access the shelter when the driver took his break but unfortunately he wouldn't let us in. We rushed back onto the train when the driver reappeared and headed off.



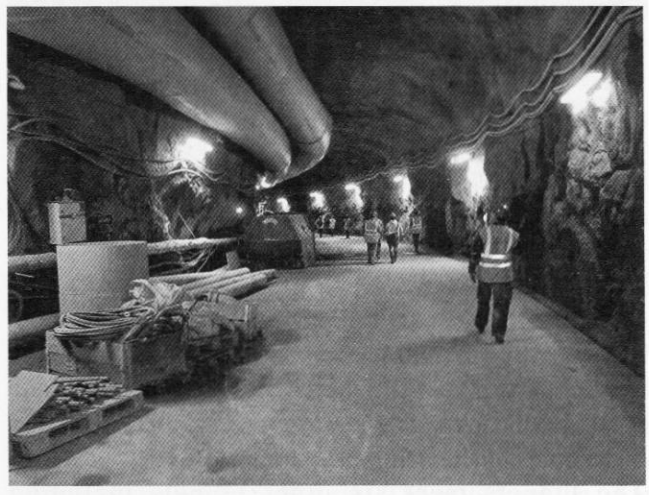
Entrance to the 'open day' on the Citybanan project, held at least once a year, this year at two locations. Photo Clive Penfold

Railway tunnel under construction – "Citybanan"

We were really lucky and privileged today as the construction site for a massive new railway tunnel under central Stockholm was having a general open day to involve the locals in the project. We queued up early to make sure we could get in – by the time we came out there were hundreds queuing, all being offered free coffee and cakes by the helpers. The site is only open one day a year and Lars had succeeded in making it the weekend of our visit! Lars spoke to the people in charge and we were split into two groups with guides who could speak English.

"Citybanan" is the working name for the new 6 km railway tunnel under Stockholm – the commuter trains, freight and the national rail all compete for the same tracks. These tracks only have a capacity of 28 trains per hour with a total of 24 trains run per hour at peak time. All trains going from southern Sweden to the north also need to go through the city and due to the amount of water surrounding Stockholm these routes are limited. This congestion is further compounded by the bottleneck created by railway traffic from the south coming into the central station in Stockholm. Thus the need for a new tunnel.

The Citybanan project was started in 2009 and is due for completion in 2017; the total cost projection is approx ¸1,630 million. It will be a two-track system for the commuter trains. Two new downtown stations are being built at the same time and together will increase capacity to 48 trains per hour. The maximum depth of the tunnel is forty metres (part of which will run under the existing metro system), which produces an incline of up to 3%. See www.citybanan.se (Swedish site).



Walking along the construction tunnel down to the main tunnel system. Photo Clive Penfold

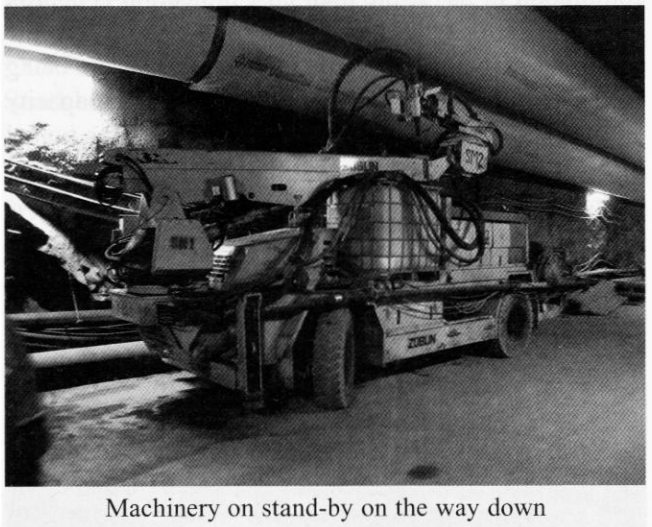
Once equipped with our hard hats and hi-vis vests we were ready to go (apparently it was also OK to wear shorts and sandals). We started just inside the entrance to the site where we stopped by the small shrine to St Barbara, patron saint of miners. Our guide also happened to be the main safety officer for the site and mentioned

that looking after the site was a working partnership between him and the saint!

Into the tunnel construction

We then moved down into the service tunnel. This has also been designed as a rescue tunnel and parallels the running tracks. Rescue tunnels were not routinely built in the past but because of various accidents around Europe over the last few years they are now mandatory. The rocks are blasted out using explosives with 8–9,000 tons of spoil being produced every week. This rock is taken away to be processed and will eventually be used as ballast for this and other projects.

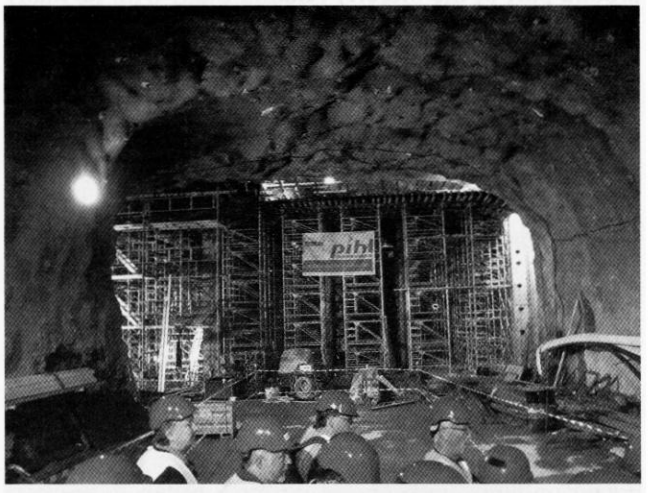
Machinery inside the tunnel. Photo Lars Hansson



Machinery on stand-by on the way down
Photo Clive Penfold

Walking into the main running tunnels we were able to see the huge machinery being used including the enormous screeding machine for applying concrete coating to the tunnel walls. Any project of this type would be complex but here they have even more complications. The tunnels meet six other tunnels including telecommunications, other metro tunnels and only one metre above is a waste-water tunnel. There is also a church sitting atop the area so to deal with all these issues they have created an artificial roof out of rock.

The final stop in the tunnel system was to see the tunnel section which heads off under the water. There is a main scaffold wall for the tunnel, which will be pushed around 30m under the water. This total section will be around 330m long with three individual submerged sections each around 100m long all meeting up. We were able to see these sections being started close to where we entered the site.



End of the mountain tunnel and start of the tunnel beneath Lake Mälaren. Photo Clive Penfold

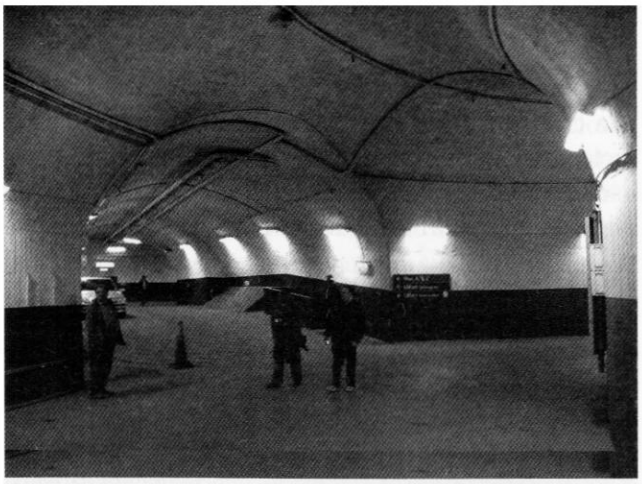
Coffer dams are being employed for the tunnel and the short section has emergency doors in case of flooding. By this point the guides were rapidly trying to edge us out of the tunnel, but this was made tricky as Martin was being interviewed by their own PR team about our visit! We were supposed to be time-limited but both our groups managed to squeeze quite a bit of extra time out of the tour.

After we emerged from the tunnel we availed ourselves of the free refreshments that had been kindly provided by the construction company. The coffee and cinnamon buns went down very well whilst we looked at the displays and video. Lucy Sparrow and I also managed to get a balloon each (meant for the children) which provided a handy visual guide for the group during the rest of the day.

Katarinaberget – Sweden's largest civil shelter

After the Citybanan we headed to the Katarina bunker near Slussen metro station. Lars was doubtful about our chances of being able to view inside, as it is now a gated car parking garage with coded entry. Fortunately we managed to sneak in as a car owner was leaving – an extra bonus site for the weekend.

This bunker was one of six or seven major shelters in downtown Stockholm, most of which are now garages. It was built 1952–57 and designed to accommodate 20,000 people standing or 5,000 sleeping. This large site consists of three wide tunnels on top of each other with two main car entrances and an additional eleven pedestrian entrances. These entrances were each around 50m wide in order to rush people into the bunker as quickly as possible. The site could also store 200,000kg of ice in basins in order to cool the site.



Spiral road allowing cars to descend to the three floors of the shelter. Photo Clive Penfold

We walked down a level from one of the car entrances and then along the whole length of 480m, stopping to wave at the security cameras on the way. We then come back up to the higher level and back along the tunnel. The scale of the bunker is incredible and there is more than sufficient room for the five hundred cars that the garage can now accommodate. See also the article in *Subterranea* Issue 11 (August 2006), page 44.

After the visit we walked back to the square where we had lunch (punningly obtained from Subway!). Following this sunny interlude we walked up to the top of the hill where according to Lars one of the main entrances to the Katarina bunker is located. Apparently a large entrance would open from under the park à la Thunderbirds and Tracy Island. Although many of us were sceptical, we saw a bunker later in the trip that would support this theory. Whilst on the 'mountain top' we took the opportunity to walk along the Katarinahissen – a walkway that is accessed from the top, with the far end jutting out to give access to an elevator some 38m above the waterfront below. This gave us spectacular views over the city.

Halfway point in the Brunkebergs pedestrian and bicycle tunnel. Photo Lars Hansson

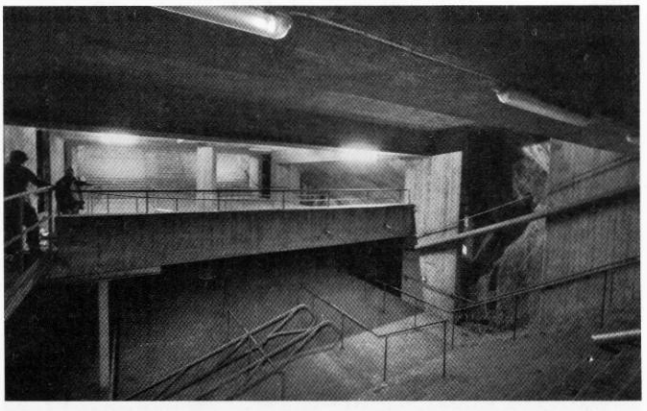
Brunkebergstunneln – pedestrian tunnel

Another short journey on the metro took us to the Brunkebergstunneln. This unusual tunnel was built for pedestrians and cycles in 1884–86 to shorten the journey through the Brunkeberg esker (glacial ridge) on which this part of the city is built. There were problems during construction with the western part due to the soft *esker*. A freezing machine from England was hired to freeze the soil to minus 18 Celsius to be able to dig it out. The tunnel sits 15–20 metres below street level and is 231 metres long, four metres wide and 3.9 metres high.

When we arrived at the tunnel we realised the steps up and around the entrance provided an excellent opportunity for a group photograph ***(see back cover).*** We then walked through the tunnel which had a slightly 'Doctor Who' feel to it due to the metallic lining. There was a section in the centre of the tunnel where the lining had been removed to show the exposed rock underneath.

Johannes civilian shelter

Our final site of the day was the Johannes shelter, which sits under the Johannes church. The shelter was built in the 1950s and is the third largest in Stockholm. Like many of the other shelters it is now used as a car park but originally could hold five thousand people. It comprises two tunnels on top of each other with four entrances.



Two of the four pedestrian entrances to the shelter, leading to both floors of the two-storey-high shelter. Stairways on the upper floor are painted green while red is used on the lower floor. Photo Lars Hansson

We had a great chance to explore the emergency exits and original entrances, which had colour coded stair rails to guide people to the correct area. These stairways are abandoned, and not incorporated into the car-park usage; they are covered in dust and grime and gave a chilling feel to what it would have been like to be shepherded into the shelter in a time of emergency – how long would you have survived? What would the world have been like outside when (or if) you emerged? There are also over-pressure valves still in situ. The exits from the wide staircases, finishing at the surface with easily removed concrete slabs, were exactly as Lars had previously described on the surface above Katerinaberget, giving credence to the idea of the removal trapdoors to disguise the exits.

Another lovely dinner

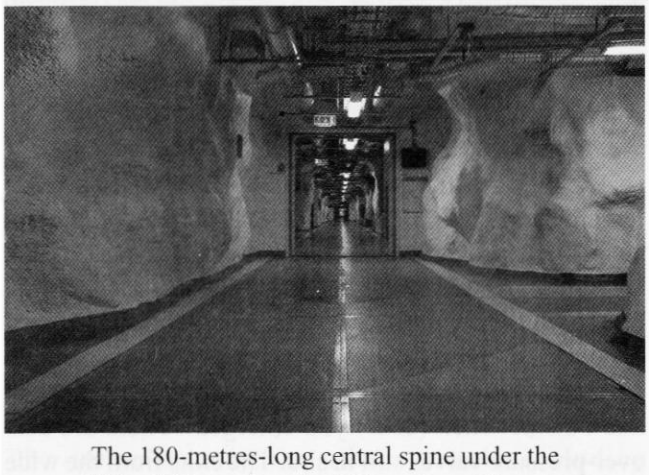
Once we had finished exploring everyone went their separate ways before regrouping for our scheduled

meeting time in the hotel reception area. A short walk took us to a local restaurant for a traditional Swedish meal. The main dish was Beef 'Rydberg' consisting of small pieces of fried beef accompanied by a large heap of chopped fried potato with a raw egg sitting atop in half its shell. The idea was to cook the egg by pouring it over the hot potato. It was a different and delicious dish accompanied by some excellent beer and wine. A dessert of ice cream with mixed berries and sauces followed and then came the speeches.

Paul Sowan and David Ferris took to the floor to thank Linda, Martin and especially Lars for the trip. Martin then took over to thank Lars and present him with a book on French WWI tunnelling – the book couldn't be on Sweden, as Lars has either written or published all the books there are on underground Sweden! Lars then returned everyone's thanks and commented that it was also a very enjoyable weekend for him – although it hadn't finished quite yet. We eventually took ourselves back to the hotel where it was decided that it was too early for bed and that conversation and vodka tasting (other alcoholic beverages available) were a more preferable idea.

Day Four – Monday 9 May – Södersjukhuset emergency hospital

Off on the T-bahn again to our first site of the day – again in glorious sunshine. This fully equipped emergency hospital bunker was constructed during WWII and is located inside a rocky hill beneath the main hospital. It has its own railway platform tunnelled into the rock, although the line is now disused. The intention was (and to some extent still is) that up to four hundred wounded could be transported to and transferred into the hospital whilst being protected underground.



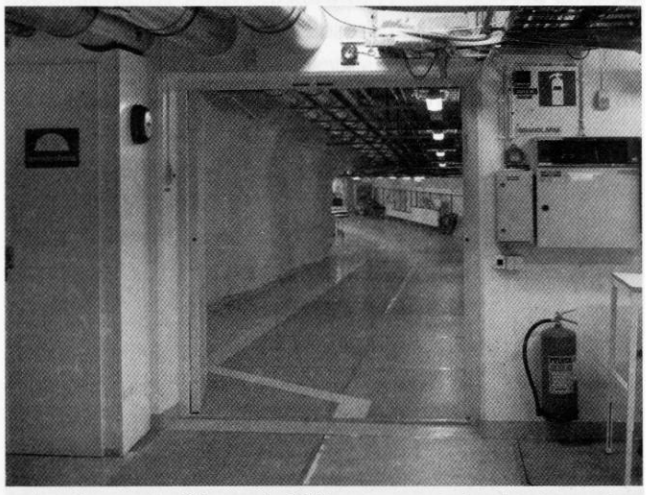
The 180-metres-long central spine under the Södersjukhuset hospital. Photo Lars Hansson

The project was dropped in the late 1940s and the underground tunnel was used as storage up until the 1990s. A Disaster Emergency Centre was then created in the old bunker system as at that time there was no decontamination station in Sweden. It was finished and ready for use in 1994. Up to 160 patients could, and still can, be cared for here, with self-sufficiency of air, power and water. It is now a first-rate modern decontamination site with interlocking doors. It can cope with civilian disasters as well as military, for instance a car accident if a chemical truck were involved or an incident at a factory using caustic chemicals. For this purpose, it gets used about once a month and can be operational in minutes using staff from the hospital above.

We entered the site from outside under the helipad and explored many of the rooms along the main 170m-long spine. Some of us particularly enjoyed looking at and photographing the hazmat suits, gloves and gas masks.

Gas masks are used for training but also available for patients if required. Photo Clive Penfold

There are twelve major rooms, containing two operating theatres, intensive care and nursing rooms. Most impressive are the rooms at the entrance to the site, where there are three stages of decontamination for casualties arriving. Each room is fully laid out and 'ready to go'. When not being used in an emergency, the site is currently used for teaching and training and they conduct exercises six to eight times a year. The site could also be used as a shelter with a capacity of three thousand.

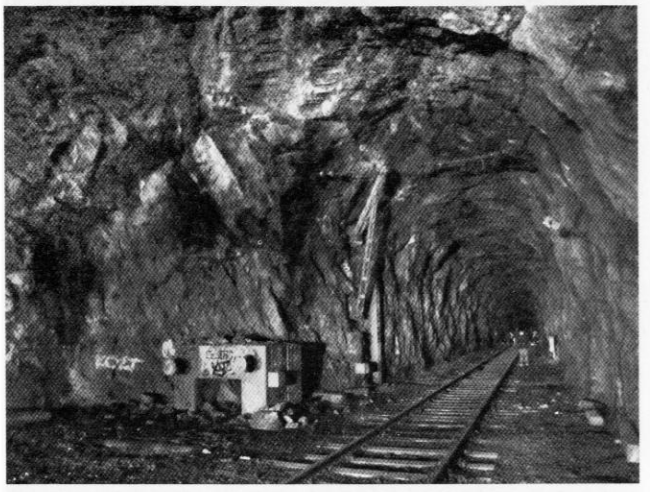


Another part of the main 180 meter central spine towards the entrance to the decontamination area. Rooms along the central corridor are now generally only used for training, while this part can be activated in case of emergency such as a chemical accident somewhere in the greater Stockholm area. Photo Clive Penfold

We left the bunker by the alternative exit stairs, which come up into the main hospital basement.

The abandoned railway tunnel

We then walked to our final Stockholm visit, a nearby abandoned railway tunnel. The railway line is part of the system that connected to the hospital and is usually closed except for the occasional organised concert and disorganised graffiti. We walked the length of the tunnel and back, John Lill and Stewart Wild stopping to check that the track was standard gauge – which it was.

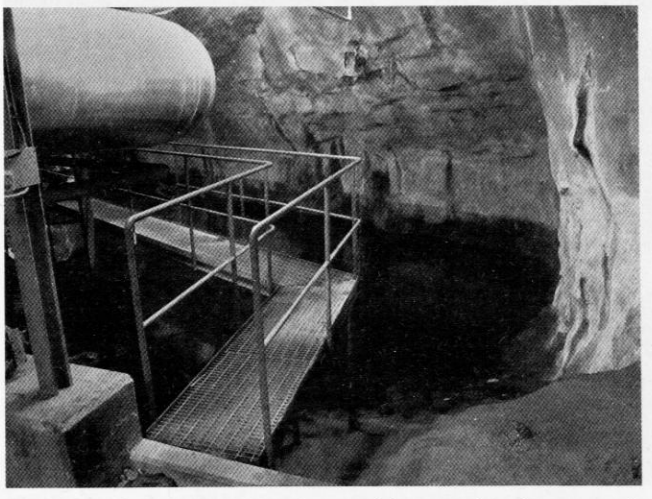


The abandoned railway tunnel under Eriksdal in Stockholm. Photo Clive Penfold

Once we had finished exploring the tunnel we took our last ride on the metro back to the hotel. We collected our bags and our packed lunches and then it was all aboard the coach for the trip back to Skavsta, with two more adventures en route.

Oil-storage depot at Oxelösund

The oil-storage depot at the harbour of Oxelösund is an incredible site. This underground facility built in the 1950s holds up to a million cubic metres of fuel oil in seven raw rock caverns. That's equivalent to a 100-metre cube of storage. The caverns are 43m underground and access is primarily via a metal spiral staircase. For the slightly less mobile (and those of a more nervous nature) there is also a lift. However, as it holds a maximum of four people, the majority had to walk down and of course back up at the end of the tour. It was an incredible privilege to get into this live working site – pity the UK aren't more relaxed in their Health & Safety regulations.

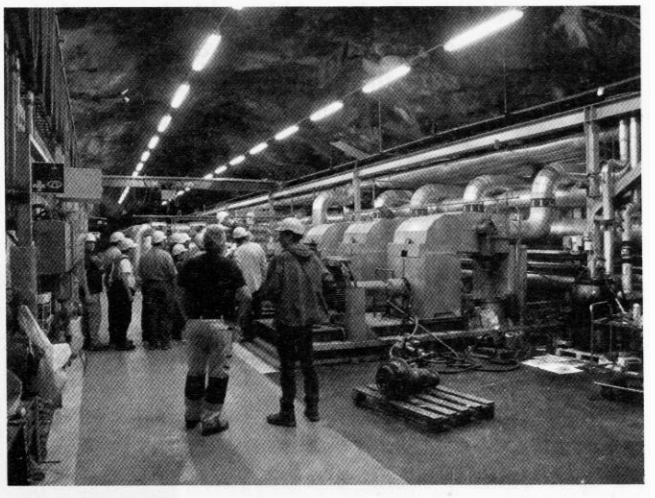


Pathway in one end of the depot with water level to control and check for oil leakage. Photo Clive Penfold

We started our tour in the central hall through which the oil is trans-shipped from the nearby docks. Underground it was really hot as the oil is heated to about 50 C in order for it to remain fluid, due to its inherent poor viscosity. Storage chamber Number 1 is 250 metres long, 18 metres wide and 35 metres high. Chamber Number 3, which is the smallest, can hold around 100,000 cubic metres of oil whereas the largest (Number 7) can hold 250,000 cubic metres.

As the caverns are below the ground water level it is possible to store the oil directly in the rock. The oil is safely contained without any need to line the rock caverns, as the surrounding water table is at a much greater hydrostatic pressure. A small amount of ground water seeps into the caverns and is removed from the oil before it is pumped out.

The system can pump up to 2,000 cubic metres of oil per hour and last year they handled around two million cubic meters. The site is the largest in Europe and one of the largest in the world.

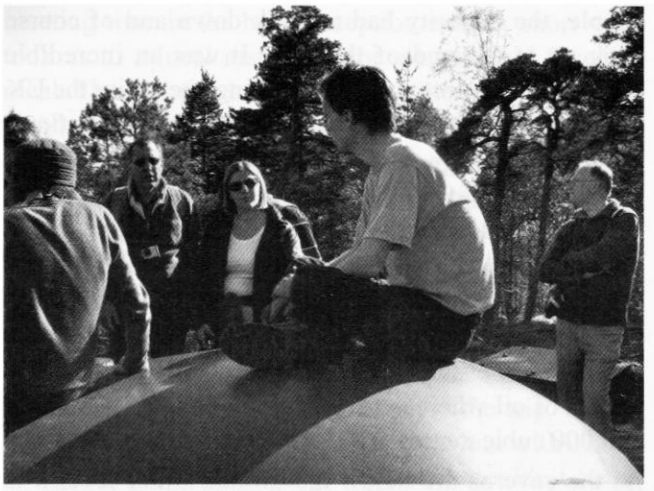


The lowest level in the depot with pumps to control the five major caverns. Photo Clive Penfold

Originally the site was created as a store for the big power plant in Västerås. During the Cold War the government demanded that ten percent of the storage capacity should always be in the tanks and available for military use if the Cold War got colder. This facility was built as and still is a privately owned site designed to store oil for a profit and to this end several of the storage chambers are hired out to foreign oil companies.

Femore fortress and coastal artillery battery

Finally we were able to visit what should have been our original starting point – the Fortress at Femore. This was a particularly important site for Lars to show us, as he is part of the group that has taken over and now runs the site.



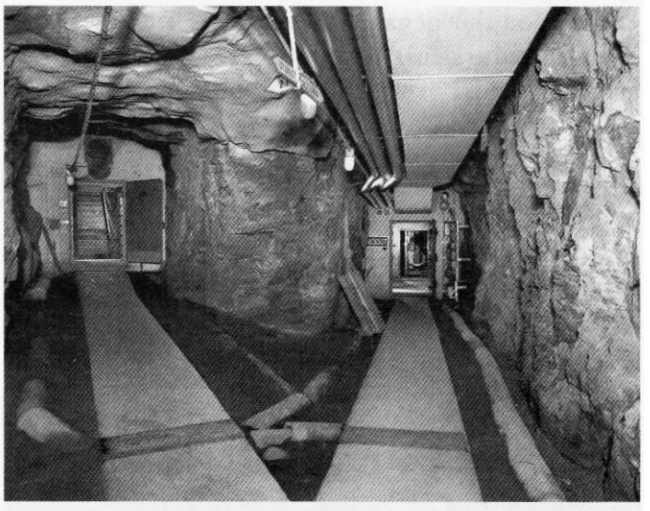
Lars trying to explain the theory of Swedish coastal defence on top of turret 1. Photo Linda Bartlett

The fort was built during the Cold War when the Swedish Government took the threat of a possible Soviet invasion (rather than nuclear attack) very seriously. It was built between 1962 and 1964 and kept operational from 1966 to 1998. It was not permanently manned but instead various exercises were carried out during the year. The personnel who manned the site belonged to coastal artillery, a special section of the Navy. Most of the equipment was checked monthly, with the guns being checked yearly. As most of the men were locals, the site was designed to have the first gun operational within 24 hours, with the second and third guns being ready twelve hours after that.

After leaving the coach and walking through the surrounding woods we started our tour of the site at the top of a gun turret overlooking the bay. Looking out over the archipelago Lars told us something about the site's role in coastal defence. As well as the three guns there was also a system of fake radar and turrets. Fake locations were set up to confuse enemy aircraft. (the tank turret was used as local defence of for instance a bay)

When operational there were three Bofors 7.5 cm gun turrets from model 1957. The guns were sited 200m apart in order to resist attack better and provide better coverage when targeting enemy ships. The guns were semi-automatic so although the firing rate depended on the speed of the person loading, they could fire about 25 rounds per minute with a 360-degree range of rotation. The artillery had a range of 13 km with a radar range of 60 km. As winters can get particularly cold in Sweden the periscope glass was heated so it would clear more easily.

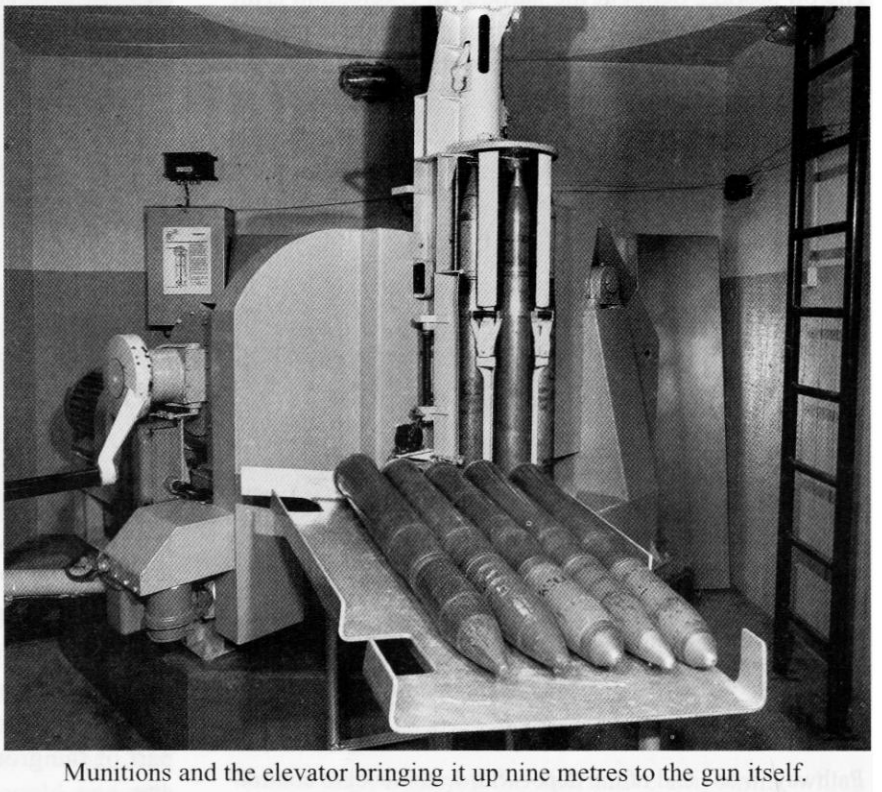
There were also three controlled minefields in the surrounding area. During the Cold War period locals were allowed into the area (except when firing) but not foreigners or – as Lars referred to us – aliens!



Tunnel with entrance to turret 2 to the left and main ventilation plant and filters straight ahead. Photo Nick Catford

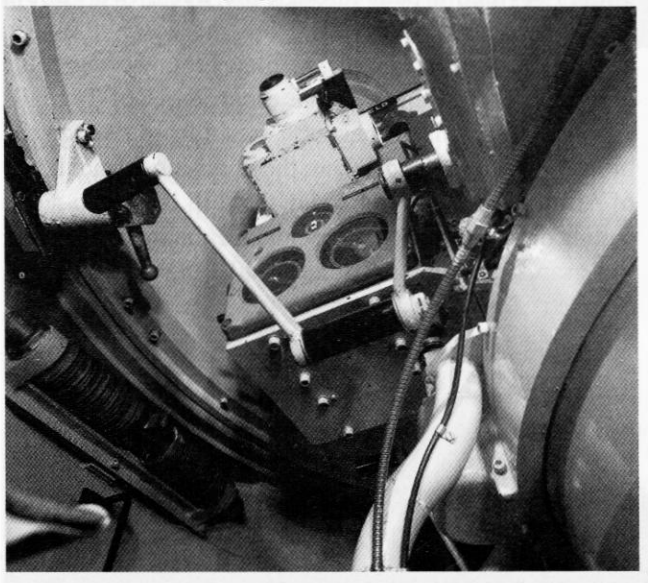
Underground Femore

We then headed down into the fortress itself. When functional it was a radar-operated measuring station with optical and laser range finders. It could carry out operations for thirty days without connection to the outside world as it was self-sufficient in water, power, food and air. The site was totally NBC-proof and apparently able to sustain an indirect hit of three times the Hiroshima bomb 500 metres from the site, or a direct hit of a 500kg mine-bomb.



Munitions and the elevator bringing it up nine metres to the gun itself. Up there three men handled the gun, reached by the ladder to the right. Photo Nick Catford

We all congregated in the main control room, which was the only large room in the site and would have been used to provide meals or to treat any wounded. Lars gave us a little more information and then we were free to wander by ourselves. One turret section has been kept in the same state as when decommissioned, with a Bofors 7.5 cm gun. This was not the same gun we saw at the top but they are identical and now we were able to look at it from inside the bunker. There was a queue to sit in the firing seat – very cramped – and imagine the noise and shock waves if it had been used! Other sections of the fortress consists of radar, fire control, dormitories, tool shops and laser ranging, all still accessible.



The turret chief's seat and controls in No.2 turret. He fired and positioned the turret correctly sideways and could look outside through a periscope. Above the dark blue box there is a sign says 'eld' (fire) and when that blue light came on he was allowed to fire. Photo Nick Catford

The system has a total of 600 metres of tunnels at a depth of 22 metres. The central spine is 1m above sea level in order to protect from tsunami shock waves. The site operated with a total of seventy personnel with seven per gun and twelve in fire control.

Rescue of Femore Fortress – and time to go ...

After 1998 the site was just left, waiting for destruction. In 2001 a group within Oxelösund started work to save part of the fortress and Lars was involved from the beginning.

In 2003 the Oxelösund community bought the site from the Swedish government and an agreement was made with the Femöre Fortress Society to run the site as a museum about the Cold War. At the time of taking over the site the spines leading to no. 1 and no. 3 guns were stripped of equipment. The site is now used for educational purposes with various groups and schools visiting.

After a thrilling afternoon, having loads of time to thoroughly explore the site, we made our way back to the coach for the short trip to the airport. We all said our goodbyes and once again thanked Lars. Then we made our way through to the departure gate, most of us having a bite to eat and a drink before the flight at 2155hrs. Luckily there were no delays to Ryanair this time – so we got home very late, very tired but very happy – what a good 'weekend'.

The author would like to acknowledge the contribution made by Lars Hansson. The information he provided for our trip formed the basis of this article. Thank you, Lars!

See also *Subterranea* Issues 13 (April 2007) page 52; and 19 (May 2009), page 27, for further articles on Sub Brit visits to Sweden.

FROM THE ARCHIVES

Cellars or 'crypts' at Rochester, Kent By Paul W. Sowan

Considering that one might almost claim that 'no English parish history can be considered complete without a secret tunnel' it is somewhat puzzling that Smith's history of Rochester is almost devoid of any mention of any underground sites! Given that he fails to include a chapter on fortifications younger than the Castle (perhaps on the grounds that they might still in 1927 be regarded as a military secret) there is a complete dearth of mentions of tunnellings and delvings into the chalk which underlies the whole city. The World War II air-raid shelter tunnels and Shorts' contiguous subterranean factory on the right bank of the Medway, of course, were still in the future when he was writing between the two World Wars. Strood, on the left bank of the river, certainly had chalk mines (below brickfields at Frindsbury) but this was outside the city limits. All Smith (an Alderman, and Mayor of Rochester for the years 1903 and 1904) offers us is brief mentions of 'crypts' or cellars below several of the public houses (the George Inn and the Crown Inn), the Old Vicarage on Boley Hill, and the Bishops' Palace on St. Margaret's Street.

Of these he tells us (on page 478) that ...

> An old house in the High Street, built about 1300, and then occupied by some person of importance, possessed a vaulted crypt. That crypt still remains, though the original and probably other succeeding houses over it have been pulled down. The present house is known as the George Inn. The crypt is oblong, fifty-four feet in length, sixteen feet in width and eleven feet in height, and divided into four bays.
>
> Another crypt existed under the old Crown Inn, and dated back to 1300. This house was occupied by Symon Potyn in 1316. Subsequently it was frequently used as the temporary resting place of many royal and distinguished persons.
>
> The Old Vicarage, on Boley Hill, and which originally formed part of Satis House, has a small crypt existing, and probably extended beyond its present limit.
>
> Under the present Bishop's palace in St. Margaret's street, formerly known as the Old Palace, there are two bays remaining of an old undercroft, similar in character to that under the Old Vicarage.

On page 287 he also mentions the crypt at the Cathedral.

The Hindhead Tunnel Walkthrough

By Nigel Headley

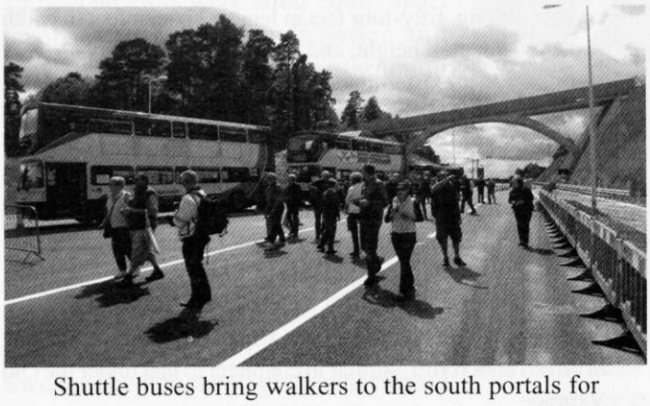
Willy Wonker's golden ticket was never harder to win than this. The widely trumpeted 'Walkthrough' (of the new A3 road tunnel at Hindhead, Surrey) lurked mysteriously on various teaser emails describing the fund-raising and PR event. Much as with the now-familiar style of the Olympic ticket fiasco, we were led to believe that long-term interest in the project might count in our favour – hopes sadly dashed when we were told it was to be on a first-come first-served free-for-all.

Midnight.....

This was an issue many Sub Brit members soon became aware of on the day of the ticket release – the booking website crashed and countless applicants were buried in the ether. For my own part, I reasoned that the late night would see Internet traffic drop. This proved correct and a midnight application moved slowly forwards, three tickets falling into my lap at the first attempt. Subsequently, my initial sense of elation was somewhat tempered by the plaintive cries of lost souls who had not been so lucky.

....Feast

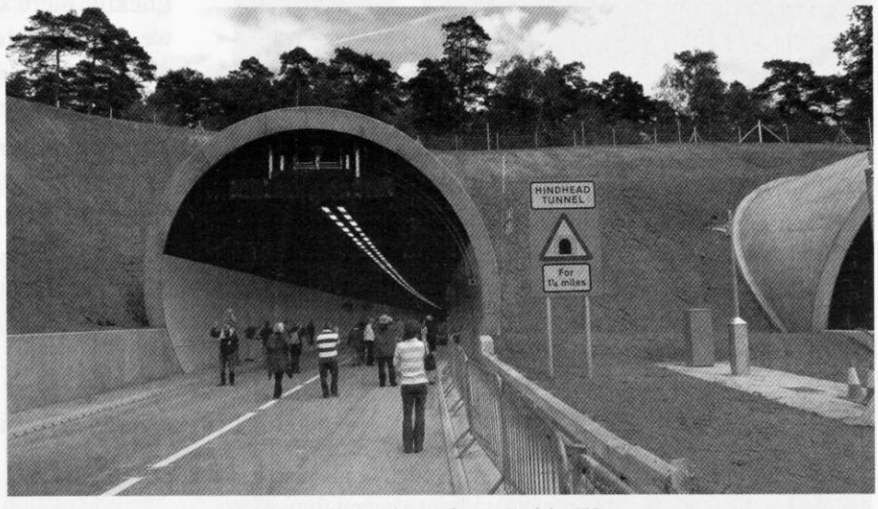
Saturday May 14 dawned and Linda, Martin and I met to park our cars at our scheduled pick-up spot, the *Three Horseshoes* in Thursley – a picturesque pub in a rural setting, usefully on the London side of Hindhead. We tucked into a fine BBQ spread produced specially for the day and in due course a small bus collected us from the front of the pub to ferry us south to the portals at the southern end of the tunnels.



Shuttle buses bring walkers to the south portals for the start of the walk. Photo Robin Ware

In the early days, it was impossible to visualise the proposed tracks of the new by-pass; the geology is complex and the area heavily wooded. But as the course cutters scythed a path through the trees, two valleys emerged, one at each end. From the north, the road sweeps round into Boundless valley. From the south, the old A3 spears straight at the escarpment of Tyndalls Wood. Before this all began, it was a huge rise, on the brow of which sat Undershaw, the imposing former home of Arthur Conan Doyle. Today that hill is a steep-sided cutting dropping to the tunnel entrances below and leaving his grand residence perched oddly behind a fence, boarded and derelict whilst in search of a future.

The tunnel is the largest UK road tunnel that does not pass beneath water. There are longer canal and rail



The walk begins. Photo Robin Ware

tunnels (Standedge and Severn respectively), and of course the UK 'half' of the Channel Tunnel. What makes Hindhead unusual is that the main reason for burrowing is to avoid a by-pass disturbing the Devil's Punchbowl Site of Special Scientific Interest. Forty years ago, no doubt, the solution to the pinch point in the centre of Hindhead village would have been a surface by-pass cutting a swathe through what is now a protected environment.

Carnival Atmosphere

Running to a strict timetable, waves of nearly seven thousand lucky ticket holders were brought to the tunnel mouth and after posing for the obligatory snaps, we strolled down the gentle incline of the northbound tunnel. There was a real air of carnival about the proceedings;

people were in fancy dress, and music from a local band awaited at the far portal – although our progress was literally and figuratively pedestrian so they'd packed up by the time we got to the other end!

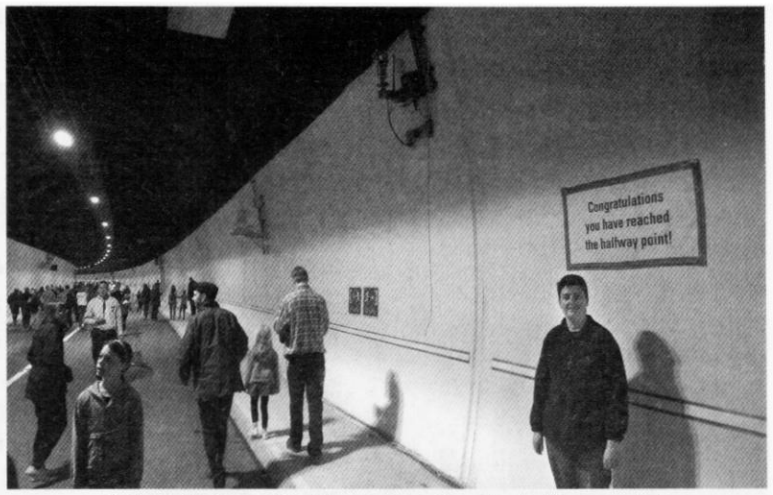
There is much technology in evidence; the physical boring and lining of the tunnel must have been a small percentage of the total bill. Each tunnel is dual carriageway. One is struck by the brightness of the lights which gradually reduce in brightness to allow drivers' pupils to gradually adjust. These lights are also computer-controlled in response to external ambient light throughout the day and night. At peak the lights are described as twice as bright as those at Old Trafford football stadium. In the floor are illuminated cat's-eyes which can even change colour – red being used when contraflows are in operation. Martin took a fine photo of these with his camera on the road surface. We shall not be able to retake it!

A busy time in the tunnel

High Technology

At regular intervals above us there were paired elongated funnels pointed at each other; these are to measure air quality and control fan operations. The whole tunnel is also covered by 'average speed' sensors so boy-racers beware! Described as looking like Jamie Oliver food mixers (!), there are regular radar receptors. These monitor car movements and react intelligently to any unusual vehicle movements such as crashes or breakdowns.

On top of these more hi-tech devices, the tunnel is covered by 104 conventional closed-circuit TV cameras. Included in the coverage are each of the cross-passages which have airtight doors and link the bores at intervals of just over every 100 metres (there is no separate emergency or service tunnel). In the event of an emergency, there are the usual overhead dot matrix signs and a (presumably very loud) public address system with distinctive flat cone-shaped loudspeakers. All of this technology is connected by 156 miles of cables and



Sub Brit's Jane MacGregor reaches the halfway point.
Photo Robin Ware

watched over by staff 24/7 in purpose-built service buildings – one reburied to reduce its visual impact – positioned just outside each tunnel entrance.

The various reference points were marked as we proceeded – Lowest point, Halfway mark, Deepest point (below Gibbet Hill) – and each sign was eagerly being used as a backdrop by snapping visitors. Water collects in a sump at the lowest point (around 300 metres from the southern portal) and is pumped to a tank near the northern portal, from where it is gravity-fed to a treatment plant. Martin's finest hour came when he posed and answered his own question put to a vacant on-site engineer when looking at some pipes at a higher part of the tunnel. Sub Brit 1 – Balfour Beatty nil! (it was a breather pipe for the higher-level water tank).

Back to daylight

Just over an hour after entering, we gently spilt out onto the giant runways outside the northern portal. We exited at the quiet end of the day; TV and press having gone home. Just a few stragglers and the helpers to get us back onto our buses home.

Having seen the roughness of the pre-project terrain, one is struck by the flatness of landscape now – wide sweeping carriageways flowing gently towards Guildford, high anti-noise banks either side. This was achieved entirely using the tunnel excavations; none of the 737,000 cubic metres of spoil was wasted.

I met a local dignitary who suggested that as outsiders we must have slipped through the filtering process; this was meant as a day for local people! All good fun though, and we'll never get another chance to go there again. The bus collected us and we travelled back through the southbound tunnel eventually returning to the *Three Horseshoes*.

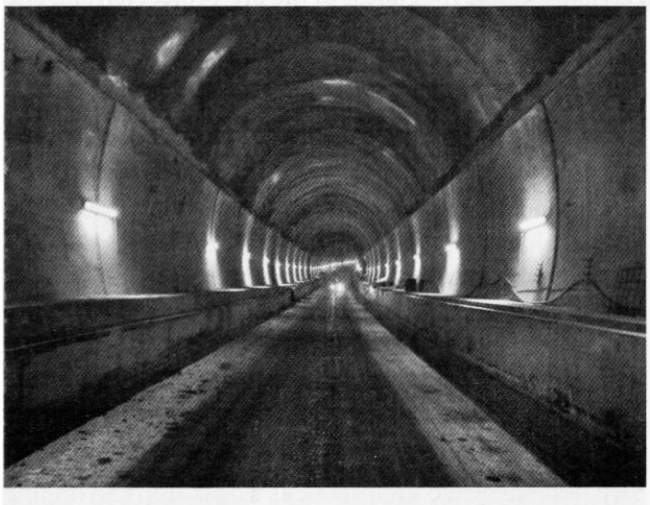
The grandeur of the Devil's Punchbowl, christened 'Little Switzerland' by the Victorians, as a backdrop to a routine outing to the south coast was going to be a hard act to replace; somehow though, the grim-sounding Highways

Walkers emerge at the north portal. Photo Robin Ware

Agency has triumphed with an imaginative and visually inspired piece of road building – it swoops low off the spine of the existing A3 and after carving through a wooded valley brings you up close and personal to two of the largest openings you'll find anywhere in the UK. Impressive from a distance and for all the world looking like two giant exhaust pipes, the tunnels have an internal diameter of 10.6 metres. The engineers described each one as capable of comfortably housing the fuselage of a 747 jet. The double-decker buses travelling through on Walkthrough day were dwarfed by it.

This finished project will let you leave London on a Friday night, safe at last in the knowledge that you will easily make that surprise birthday party in Petersfield or nail that ferry in Portsmouth. By the time you read this, the country will have been blitzed with stories about the newly improved open road, time saved for journeys, and rising property prices on the south coast caused by the faster access from London. Let's hope that Google takes the trouble to resurvey the site from the air; as I write, the A3 languishes, frozen in a past where both time and traffic stand curiously still!

Nothing has caught the UK public's imagination quite like this since the building of the Channel Tunnel; this one though has the novelty of being able to drive through it in a car and admire it in all its glory – unlike the view from Eurostar or Le Shuttle, encased in a high-speed submarine torpedo. For a brief moment in time the walkers became minor celebs; the rarity of the tickets had a national radio chatshow host asking us to call in the next day to explain why we felt the need to walk through a tunnel. He's clearly not a potential new member for Sub Brit!



Construction of the tunnels was at an advanced state when Sub Brit visited in February 2010. Photo Nick Catford

Reflections

After four years of building and four years of waiting, the Hindhead tunnels have provided a rich seam for Sub Brit members to mine and enjoy. Four years during which I've grown older and greyer, my children have married and I'm about to become a grandfather twice over! Our aged Labrador Bertie, who accompanied me on walks across early diggings and managed to lose himself in the deep ravines of the Punchbowl countryside, has now sadly died. The landlord of the welcoming *Dog and Pheasant* in nearby Brook, who provided some of the finest Sunday lunches in Surrey, has departed both his marriage and his pub.

Buses waiting to take walkers back through the southbound tunnel. Photo by Nigel Headley

But the waiting has finally come to an end and a four year watch is over.

[Editor's note: Anyone wanting more technical information should look at Subterranea Issue 23 page 46 which covered our earlier site visit, courtesy of Balfour Beatty.]

Postscript

On Tuesday 19 July, the Highways Agency announced, "the A3 Hindhead Tunnel Southbound will open to traffic on Wednesday 27 July 2011. Secretary of State for Transport, Philip Hammond, will open the tunnel. Southbound traffic will be the first to use the tunnel, with northbound traffic being introduced to the new road a few days later. The first traffic will be escorted through the tunnel in convoy, and the old road will remain in use in the meantime. For safety and operational reasons, the opening ceremony will not be open to the public."

Saving Wartling

by John Smiles

with thanks to Ed Combes, Chris Howells, Barry Stewart and Dom Jackson for images

Beyond exploring, and our academic interest in long-forgotten and oft-neglected underground spaces, Sub Brit and its members sometimes get a bit more pro-active in the opening and preservation of heritage sites: from Fairlight to Paddock, HMS *Wildfire* at Chatham, a growing number of ROC Posts, and the school and public air-raid shelters we have been finding and opening over the past few years. The list is growing and long may it continue, as making the effort is sometimes the only way we can keep these sites open for us all to enjoy.

Sub Brit has had a particular interest in the derelict ROTOR R3 bunker at Wartling in Sussex for several years now. This relationship started in earnest in 2005 when we organised a major pumping exercise – paid for through donations – which emptied several million litres of rainwater out of the bunker so we could get into the lower storey, record the site properly and open it up for access.

This project was a great success. We got into every room (which the waters had locked down for more than ten years), the owners were delighted, and we even came away with a modest surplus of funds after the landowner picked up the considerable electricity bill himself. It is extensively recorded on the SB website if you want to have a look.

As I am fairly local to Wartling, I have kept a watching brief on the bunker ever since. I pop in to visit the owners when I am passing just to check everything is ok which it is, despite regular break-ins. Over a period of about two years I talked to the owners to see what their long-term plans for the bunker were and whether they would be open to the idea of undertaking some protection works to stop it refilling or at least slow down the rate at which it leaks.

Thankfully this process was pretty straightforward as the owners are genuinely interested in the structure on (and in) their land. With permission in hand, I put out a call for volunteers in the last copy of *Subterranea* and on the email lists of a couple of other clubs I belong to. The response was fairly good – albeit with a lot of the usual faces for our more active endeavours – so we were all set. After some more detailed surveying, planning, cobbling up a design and buying materials, we were well prepared.

And so it was that on the morning of Saturday 25 June, 2011 eleven of us bowled up on site with a variety of tools, both large and small, ready to go to work.

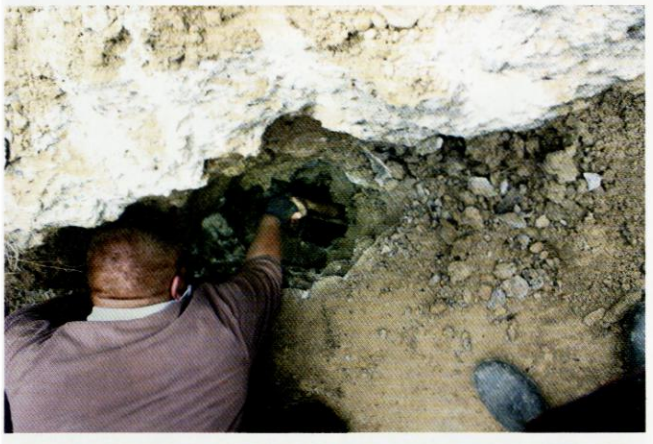
Our aim was to see if a path to the surface was feasible and do some enabling works. Instead, we completed the new ventilation and pumping connection to the surface and resealed the hole, made a walking tour of the main corridors easy and safe, did all the structural work on the demolished inlet shaft ready for waterproofing and installed two-thirds of the long-term flood protection dams. The pictures below show what we achieved…

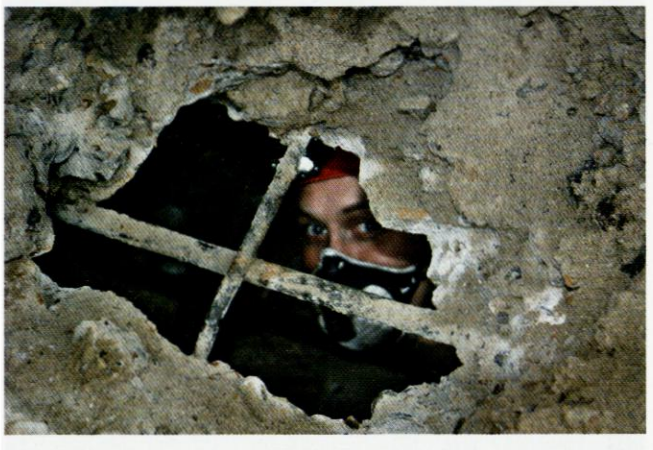
This was the scene at the start of the day; in the midst of this nettle patch is a marker post which we placed in October 2010 to mark the surface position of the cable access shaft that was demolished, knocked into the hole, and then topped with several cubic metres of concrete when Wartling was permanently decommissioned in 1976. This hole is probably the bunker's principal leak. At this stage, we didn't know if the cable shaft was topped with

a huge concrete lid shown on the design drawings that we have.

After digging down for just a few feet, David Heyes uncovered the top of the concrete plug poured in to 'seal' the hole. Turns out our surveying wasn't at all bad – the survey spike had been driven in just a few inches to the right of the slab just emerging below the excavator bucket.

Adrian Armishaw and Stuart Fraser are shown here taking turns with the hydraulic breaker to punch a new hole in the roof of the cable shaft to create a pumping route and allow us to establish a through flow of air for long-term drying out. We had originally hoped that we could cut down through the debris cone but after attempting to break up the plug, we soon realised that without a 'pecker – a machine-mounted breaker – we didn't stand a chance, far too heavy.





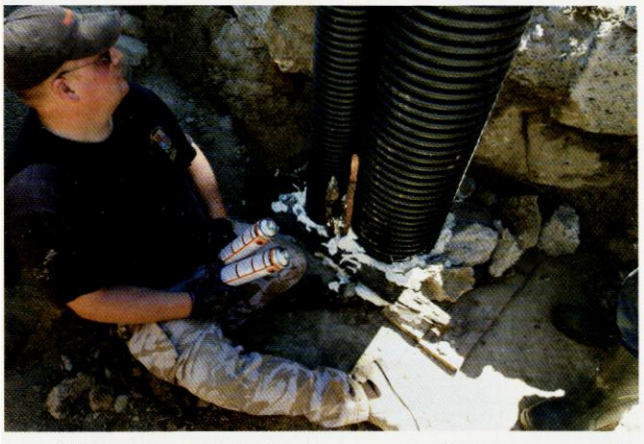
Not quite the Channel Tunnel breakthrough ceremony, but a significant milestone for us – two and a half hours and sixteen inches of reinforced ferro-concrete later, we have a connection to the surface for the first time in 35 years. Certainly worth a handshake!

Ed Combes peers up through the hole from his position, standing at the top of the cable-shaft ladder (see below). Note the size and density of the rebar – this section, which feeds into the entrance corridor between the guardhouse bungalow and the bunker, is well outside the blast-hardened body of the bunker proper which has 12-foot thick walls with half-inch tungsten steel rebar every six inches throughout.

David figuring out our 'snorkel'. This is the new ventilation route – made up in drainage polypipe so we can keep it all waterproof. This is about a foot in diameter – well below the diameter of any likely visitors – to make sure that we don't make the bunker more vulnerable by adding

The snorkel from below, the ends of the two smaller vent pipes will pierce the new tanked blockwork wall we are building to keep out the water at the top of the cable-shaft ladder.another access point.

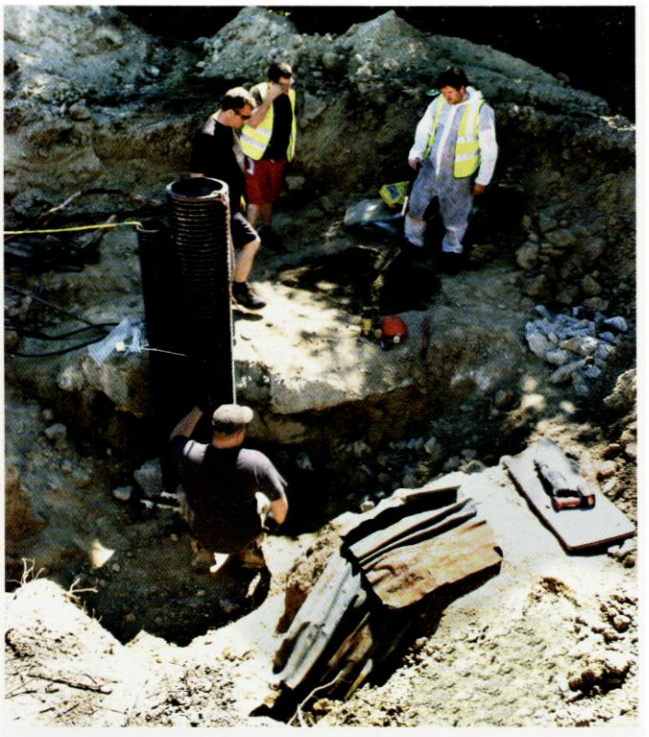
Rob Smith, Adrian and John using the new hole to pass heavy materials into the bunker and avoid a very long barrow run before the pipes are fixed in place.



David Heyes capping the pipes ready for concreting in. The one to the left is a duct for surface cables during construction and a permanent pipe for the bilge pump that will evacuate any water that does make it past the tanking.

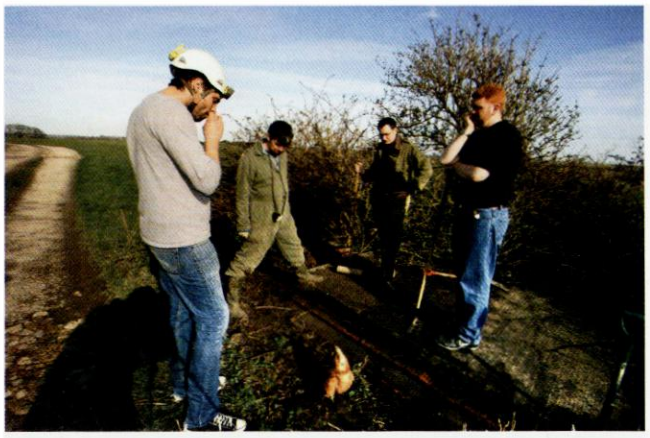
Tim Robinson, Paul Turton and Chris Howells on muck-mixing duty. The bits lying around in the foreground are examples of the copious demolition debris we lifted out of the hole as we excavated; this all went back in around our new pipe to improve local drainage, help stabilise the pipes and make any future digging extremely difficult.

And back goes the dirt (fast-forward about 14 hours work from the first image of the nettles).



Good as new – you'd hardly know we'd been here after six months. The next job is to build a surface utilities point and a short 'chimney' to help draw air through the bunker.

October 2010 – Rob, me, Jon Barker, Nick Pedley and an inquisitive chicken examine the problem with the air intake shaft (which is the second biggest leak). The demolition crew only vaguely lined up the capping slab with the shaft when they broke out the supporting



brickwork pillars. They also put three large cracks across the face of the slab.

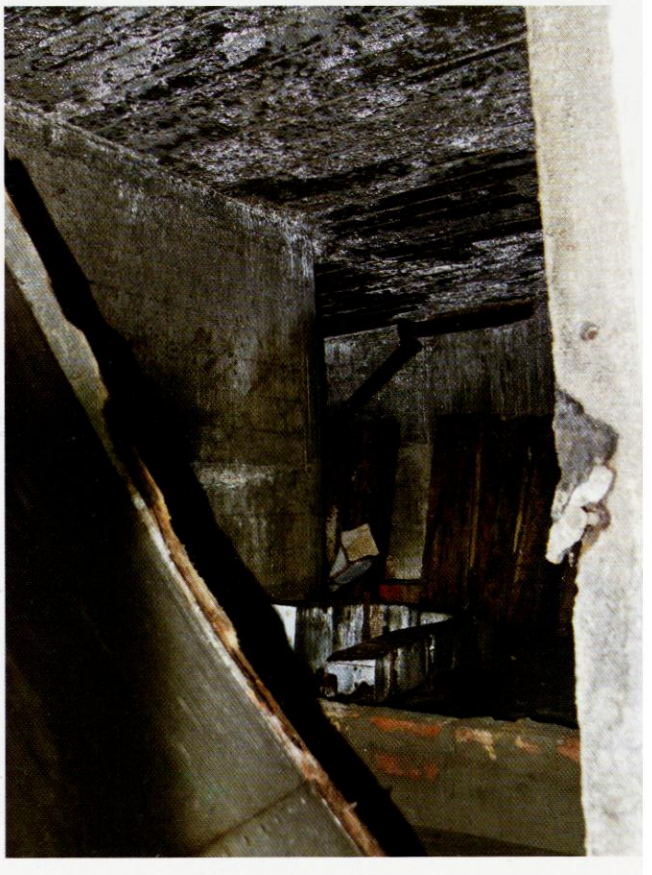
Adrian, Chris, Paul and Nick cut the brush and fell the trees.

Nick and Dom Jackson help David (in digger) to clear the slab and cut the surrounding earth down to a level where it won't run off into the bunker.

Everyone gathers round for a site meeting to decide what to do next, can we shift a five and a half tonne slab with a 5.5 tonne digger?

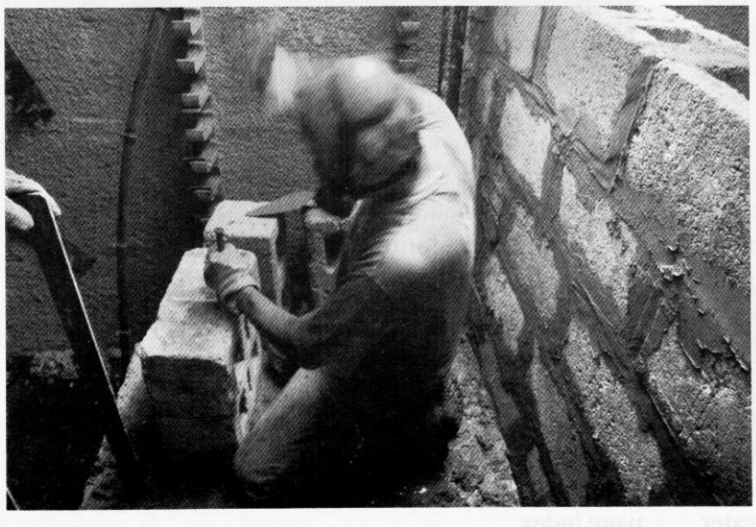
Yes we can!

A bit of tidying and flattening, and this is ready for the sealing works when we come back.

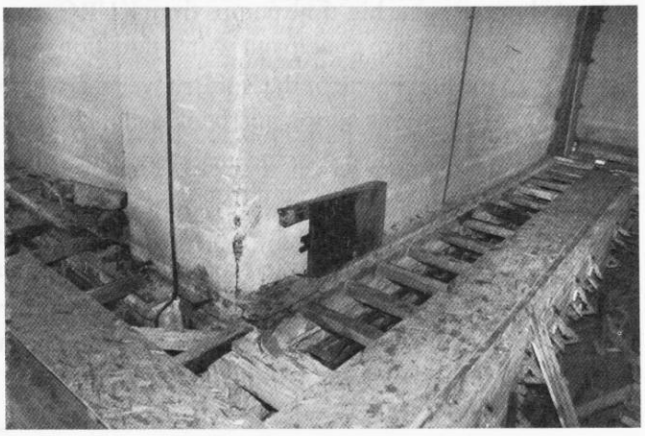


But don't worry because until we do, the tanked catch dam we have built at the bottom of the shaft can hold over 4,000 litres which can be easily and cheaply pumped to the surface before they drop into the depths of Control Room.

Much like our other catch dams, here being built by Nigel Ostler-Harris, which convert the main underfloor cableways into an enormous attenuation tank that can hold nearly 80,000 litres if the cable shaft keeps leaking – this is about three to four months flow at the current rate (that is, before we complete the sealing works) so it would be possible to simply visit and pump this tank a few times a year if need be…



…but it shouldn't be, because the final part of the sealing job is this new blockwork wall which will close off the destroyed cable shaft once complete, and will then be tanked and rendered – and backed up with yet another high-level catch dam with a bilge pump – to try to stem



the flow as far as possible. Whether this will work remains to be seen, of course.

As finishing touches, we refurbished the blast doors so they actually open, and cleared a safe walking route round all the main corridors. This involved covering all the open cable-tunnel access holes and reinstating over 35m of missing floor between the bunker proper and the entrance bungalow (shown, half finished, above).

We also retrieved some more artefacts from the slime and surveyed a new pumping route to empty the bunker using the original sewage ejection system. Flanges have been made up to connect into this thanks to Thorne Engineering (Paul Thorne, fabricator extraordinaire and Chairman of the Kent Underground Research Group). If it can be used it cuts nearly two metres off the head of water we have to pump, which will translate into a huge efficiency gain on the pumps, making the pump quicker and saving a lot of expensive power in the process.

Getting this little lot done took nearly one man-month of effort from our hardy volunteers, without whom nothing would be possible. Most have had a name check above, but I also need to thank Richard Savage, Bob Clary, Barry Stewart, Mike Hollington and Steve Underwood. Everyone put in a huge effort.

I also need to thank several Sub Brit members who already stepped forward with some very generous donations towards materials after we got through about £400 to deliver the works so far. We still need more to carry on, of course, so if you would like to help out with either cash or your time, see below to find out how.

Since June 25, another workday has been planned for Sunday 17 July when we hope to seal the cracked slab, finish the blockwork wall, fill in the last gaps in the floor and build the surface structure over our new vent. More on this next time and also on the Sub Brit website.

Get involved!

Sites like this are rare and getting rarer through neglect, so doing something to save one is a great personal contribution to protecting the built heritage of the Cold War. There are two ways you can help:

We need more cash for materials and for the cost of pumping the lower level (although we have managed to borrow some big-time pumps from KURG so pump-hire isn't a big drain on finances this time around). If you would like to help out with a donation in any amount, then please either:

Go to the homepage of the SubBrit website where you will find a link to our project page complete with PayPal donations button and bank details if you prefer transfers.

Or, for those who prefer the analogue route, just drop me a line at 41 Nelson Rd, Tunbridge Wells, Kent TN2 5AW and enclose a cheque.

As in the past, if there is any surplus left over when we are done, this will be held in Sub Brit funds ready to be used in other ways to protect our underground heritage should the opportunity arise.

Obviously anyone who wants to get their hands dirty in a filthy, smashed old bunker is also very welcome to join in on one of our work days! Just drop me a line at <smileysquad@googlemail.com> and I'll add you to the (no obligation) invites list.

Radar Chic Des Res

The converted Type 70 modulator building at Wartling, which is now a spacious house with three bedrooms, a colossal open-plan living area, roof terrace and even a sauna suite is currently vacant and available to rent at quite a competitive monthly rate. The property enjoys ample parking, complete tranquillity and clear views down across the Pett Levels to the sea at Pevensey Bay. Please contact John if you're interested.

Water Supply Aqueducts, Tunnels, and Cisterns of Byzantine Constantinople, Istanbul, Turkey

By Paul W. Sowan

Thrace, the small European part of modern Turkey, which shares frontiers with Greece and Bulgaria, lies on the west side of the Bosphorus. It included the ancient Greek city of Byzantium, established on the most easterly of the seven hills of modern Istanbul, about 657 BC, but subsequently destroyed. A new city was built on the site by the Roman emperor Constantine I [c. 288 – 337] in AD 330, and was for a time the capital of the Roman Empire in the east, and later the capital of Turkey although it lost this status to Ankara in 1923.

Some of the relatively well-known Roman covered water cisterns in the city are established tourist attractions. Very much less well-known is the very extensive system of aqueducts built to conduct water from the hills of Thrace into the city.

James Crow and others have now reported on a ten-year archaeological investigation of this water supply system in Turkey-in-Europe, and in European Istanbul, in its entirety. This is published as a substantial Monograph of the Society for the Promotion of Roman Studies.

Constantinople's three engineered water-supply channels have a total length of at least 592 kilometres, somewhat longer than the total length (520 kilometres) of Rome's 11 aqueducts. The aqueducts in Thrace were maintained and remained in use up to the late 11th century. They were built to allow a continuous and steady flow of water from as far distant as the Stranja Hills (up to 1000 metres) and took very sinuous paths, generally following the contours of the forested hilly country. At times ravines or valleys were bridged (the Aqueduct of Valens, in the city, has a length of 971 metres); and short stretches of higher ground were passed via tunnels. A number of tunnels have been examined internally, and the locations of several tunnel shafts (presumably for spoil extraction) have been identified. The water channels were almost exclusively constructed by the cut-and-cover method, and those on the surface were covered, presumably to reduce water loss by evaporation.

Whereas chapters 3 – 4 deal with the water channels outside the city, the following two deal with water distribution and storage within Constantinople, where there are or were an estimated 150 covered cisterns and open reservoirs. Chapter 7 deals with Christian and other symbols inscribed on the masonry, and Chapter 8 with masons' marks, followed by a general discussion in Chapter 9.

The volume includes numerous maps, site plans, measured drawings of built structures, and measured ground plans of cisterns and reservoirs. An appendix contains English translations (from, *inter alia*, Bulgarian, French, Greek, Latin, and Turkish sources) of major texts and inscriptions. There is a 13-page bibliography and an 8-page index.

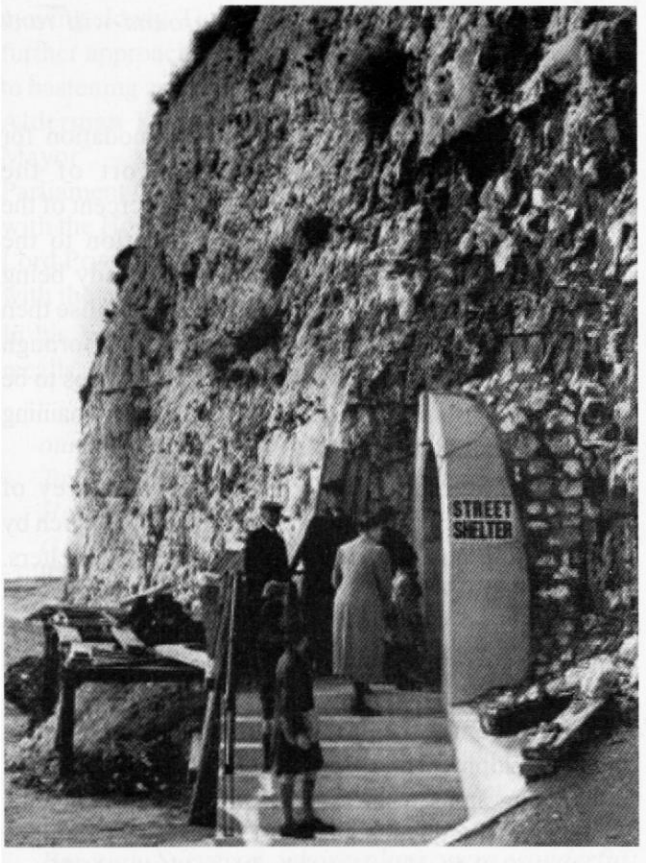
Ramsgate's Remarkable Tunnels

by Phil Spain

Synopsis

Having suffered extensively during The Great War of 1914–18, Ramsgate was acutely aware of the dangers of attack as World War II approached. Despite initial government attempts to prevent construction, the spirit of the town won through when construction and adaptation of over three miles of tunnels took place in 1939.

The tunnels are unique in the UK in that they form a single connected network that can accommodate an astonishing 30,000 people. In WWII, thousands took refuge in the tunnels and hundreds of lives were saved. They were so popular that in 1940 there were over three hundred families living below ground. Having once formed the heart of Ramsgate, the tunnels and memories of the few who are still with us from the period are now the only remaining links to this important period in the town's history. In June 2011 the Ramsgate Tunnel Group successfully secured £53,000 in funding to help preserve both the memories and the tunnels for generations to come.



West Cliff Harbour entrance

The Beginnings

In March of 1936 Ramsgate's Chief Constable submitted a comprehensive report of measures to be taken to the newly formed Borough of Ramsgate's Air-Raid Precautions Sub Committee. Ramsgate Council had not been complacent over the provision of A.R.P. shelters.

In April 1936 the Borough Council received a Notice of Motion from Councillor Miss Wilson which stated:

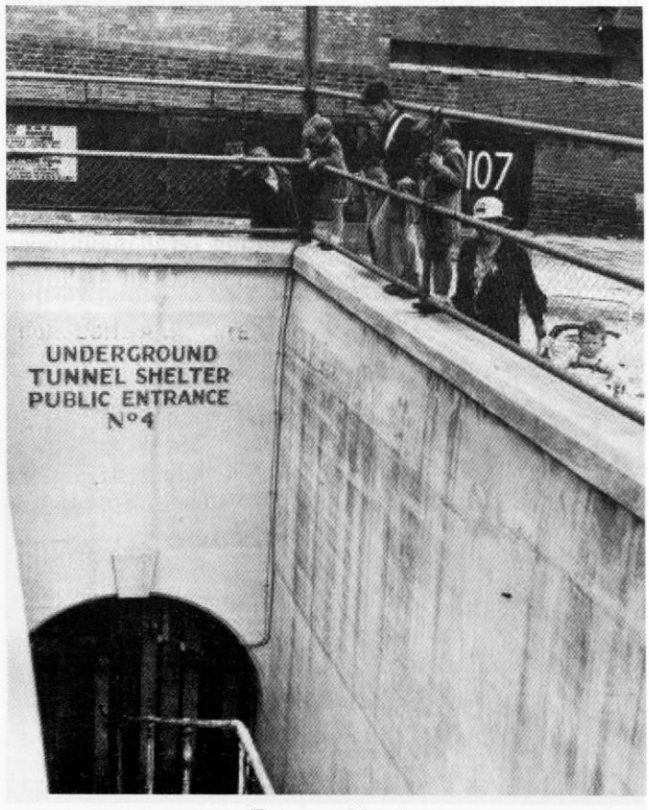
> "*It is the moral responsibility of this Council immediately to provide suitable refuges from aerial attacks or sea bombardment on Ramsgate*".

The matter was referred to the A.R.P. Committee who gave it careful consideration in the light of Central Government Policy which was summarised as:

> "*The construction on any extensive scale of shelters which would be proof against direct hits by bombs is impracticable. Such protection could be obtained only by means of concrete structures of great thickness or correspondingly costly works of equivalent strength, and apart from any other considerations the cost would be prohibitive.*"

The Committee wasn't put off by this policy and took the view that conditions in Ramsgate with regard to the provision of bombproof shelters were exceptional. The town is built on a formation of upper chalk which is particularly suitable for tunnelling as it stabilises if correctly cut, alleviating the need for supporting structures. The contour of the town is such that it gradually rises in all directions from the centre, making it suitable for a deep tunnel network to encompass the town. Ramsgate's Borough Engineer set about devising a plan to make best use of the town's natural features.

A meeting of East Kent local authorities was held on 7 July 1936 when it was agreed that each authority's own



Entrance No. 4

Air-Raid Precautions Committee would be responsible for its own arrangements. "*The schemes should be as far as possible prepared on a common basis and capable of adaption to be applied to an adjoining area.*" A coordinating committee (Joint Committee) comprised of three members of each local authority was set up to oversee the workings of each A.R.P. Committee.

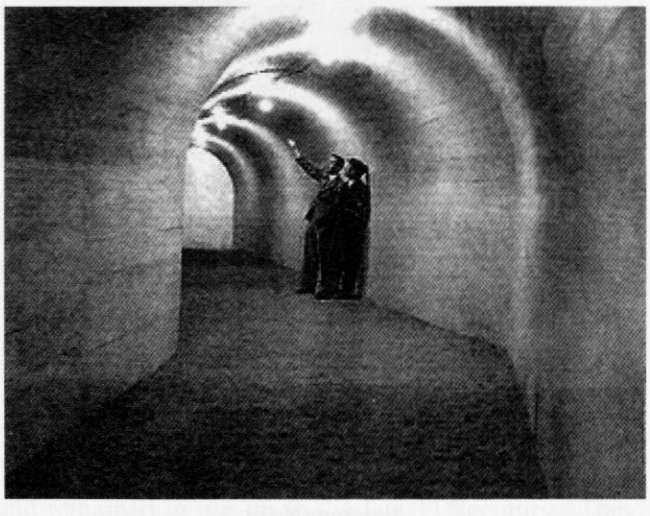
Over the next two years Ramsgate's Borough Engineer, R.D. Brimmell B.Sc., A.M.I.C.E., continued working on plans to construct an underground protection system. Discussions took place between an official of the Home Office, the Borough Engineer and the Chief Constable with regard to the possibility of using certain underground shelters which were made available during the last war, and arising from these discussions council officers prepared a scheme which, if carried out could provide extensive underground protection on a scale most likely to be adequate and effective in the circumstances. Much debate had taken place in Committee with regard to A.R.P. shelters, and on 2 June 1938 the Borough Engineer put his final plans for the Deep Shelter Tunnel System before the Council. In the debate that followed many were against the scheme as they felt there were better ways to spend the Town's money. After much discussion it was agreed to defer the plan rather than dismiss it.

Following Germany's occupation of Austria in 1938, the scheme was again brought before the Council and this time it was agreed to submit it to Government for approval and funding. The scheme was presented to the Home Office but rejected as being premature.

The Munich Crisis

In the following months attention was sharply focused on the need to provide effective shelter during the Munich Crisis, as this threatened to escalate into another world war.

In response to this crisis, and having had his own plan refused by the Home Office, the Borough Engineer submitted a plan, in accordance with government policy, outlining a scheme for the construction of sandbagged trenches, protected by concrete roofing, on all public open spaces and on certain private open spaces in the town.



Tunnel near Queen Street car park entrance

The Chief Constable reported that arrangements had been made for the use of the railway tunnel running from Hereson Road to the Sea Front, the Granville Hotel Tunnel and the caves belonging to the Roman Catholic Community at St Augustine's Abbey (Pugin's Caves).

On 30 September 1938, Prime Minister Neville Chamberlain returned home and delivered his famous speech to delighted crowds in London. He pronounced "here is the paper" referring to the agreement which was supposedly to bring "peace in our time". History recalls that this was not to be the case, however it did bring a period of respite allowing a more considered approach to Air-Raid Protection. A second application was made to the Home Office for permission to construct the air-raid tunnel system, but was again rejected on the grounds of cost and being contrary to policy.

Throughout the Munich Crisis much work had been done on the digging of trenches. The Home Office formalised their requirements and proposed "*that where trenches have been properly sited they should be completed, covered in and be given a permanent structure, provided that this shall only apply to trenches already substantially excavated viz: to a depth of not less than four feet. Where a decision is to fill in trenches the cost of filling and reinstating the ground will rank for grant on a revenue basis*".

Trenches and Shelters

Permanent trenches would afford accommodation for 2,556 persons, although this fell short of the recommendation to provide shelter for ten percent of the population. These trenches were in addition to the underground shelter scheme which was already being developed, and if such a scheme did not materialise then additional trenches might prove necessary. The Borough Engineer estimated the cost of permanent trenches to be £3,630 and the filling-in and making good of the remaining trenches to be £200.

The borough engineer also carried out a survey of basements, cellars and similar accommodation which by strengthening and adaption could be used as shelters. He submitted a comprehensive report and recommended the provision of basement shelters at 44 separate establishments giving accommodation for 854 persons including staff at the establishments. These proposals were to be complementary to the underground system under development and were designed for people caught in shopping areas where tunnels were not practicable. The estimate for this scheme was £5,935. The committee recommended that the scheme be forwarded to the Home Office for approval and associated A.R.P. grant funding.

Another tunnel application

In February 1939, as Hitler's intentions became clearer, a third application for approval to build the air-raid tunnel system was submitted to the Lord Privy Seal; correspondence was taking place, but matters were

The shelter in use

moving slowly. The A.R.P. Committee agreed to leave a further approach in the hands of the Mayor with a view to hastening an appointment. The Mayor at the time was Alderman Kempe, Ramsgate's very own "Top Hat Mayor" – a flamboyant character. The Member of Parliament Captain Balfour arranged another interview with the Home Office. Capt. Balfour also persuaded the Lord Privy Seal Sir John Anderson to agree in principle with the proposals.

In his book "Midst Band and Bombs" Mayor Kempe recalls

> *"... I headed the deputation and we had with us our Borough Surveyor, Mr. R. D. Brimmell, the Town Clerk, the Chief Constable and Alderman Huddlestone. We sat around the usual type of Government conference table; the chairman looked austere and ready for the fray. He turned to me, "Well, Mr. Mayor," he said, "What fresh news can you tell us about this project." My reply was, "We have come up here today meaning business!" He sat upright in his chair and seemed a bit ruffled. However I carried on and for fifteen minutes I placed the case before him. Alderman Huddlestone backed me up, followed by our Borough Surveyor, whose plans were wonderful; his arguments in favour were good and helped a lot. The chairman came to me afterwards and said, "I hope you think we're doing our best for you". He was told "No", and I was seeing our member about it. I took up that attitude about it because I had learnt from experience not to let them think you are satisfied."*

Finally – approval for the Air-Raid Tunnels

Kempe's involvement proved effective, and on 20 March 1939 a letter was received from the Air Raid Precautions Department of the Home Office conveying the decision of the Lord Privy Seal as follows:

> *"that the Corporation may proceed at once with the improvement of access to the Railway Tunnel and caves as proposed in the Air Raid Precautions Scheme and the construction of sections designated BA, BB and BC* (the main system) *of the new tunnel scheme."*

The committee recommended that work should commence using direct labour, from the harbour, under Addington Street and the sinking of a shaft at the junction of Westcliff Road and Vale Square. As the sinking of many construction shafts was beyond the capabilities of the Council's equipment and workforce, tenders were invited for the remainder of the work.

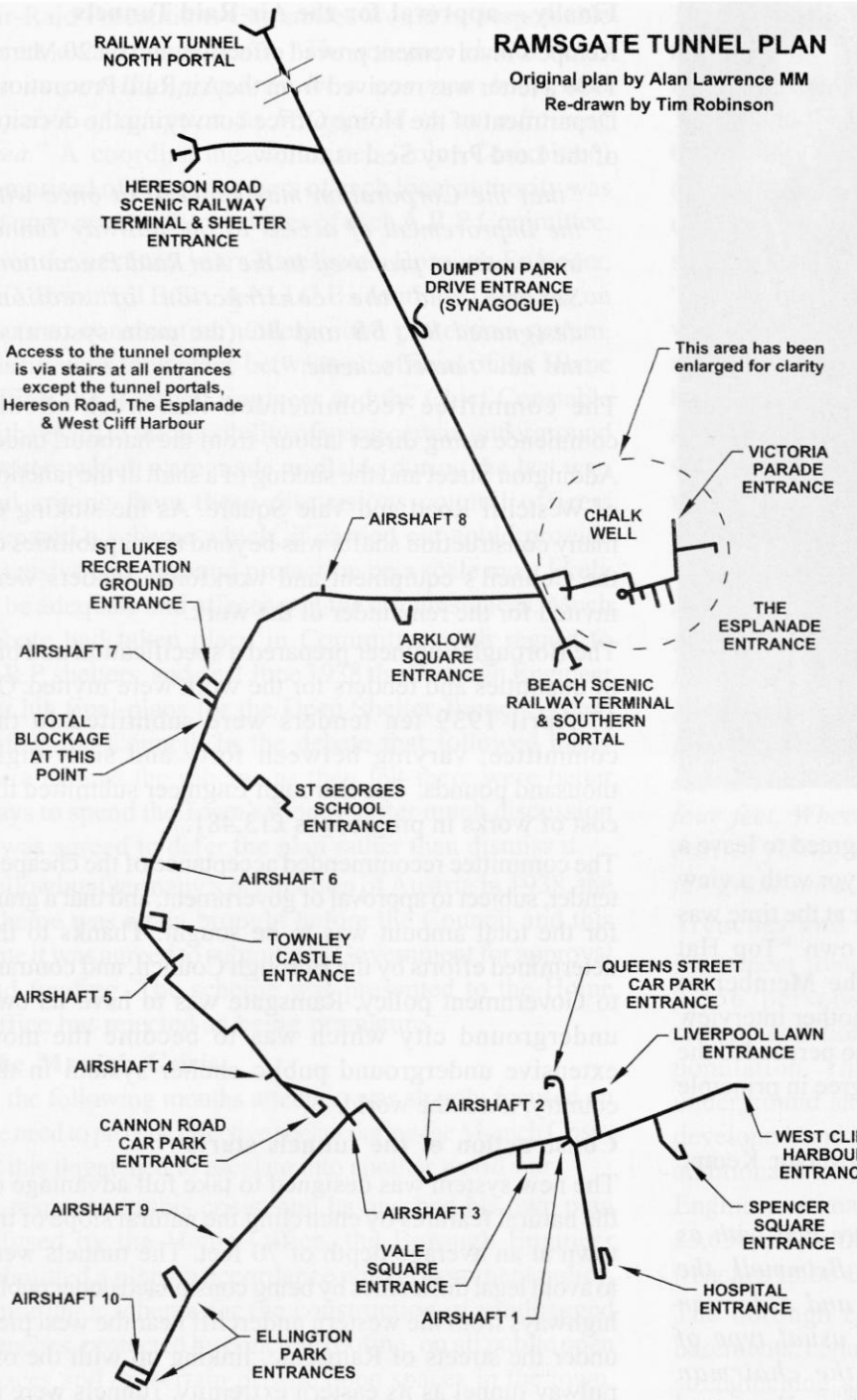
The Borough Engineer prepared a specification and bill of quantities and tenders for the work were invited. On 17 April 1939 ten tenders were submitted to the committee, varying between forty and sixty-eight thousand pounds. The Borough Engineer submitted the cost of works in progress as £13,481.

The committee recommended acceptance of the cheapest tender, subject to approval of government, and that a grant for the total amount was to be sought. Thanks to the determined efforts by the Borough Council, and contrary to Government policy, Ramsgate was to have its own underground city which was to become the most extensive underground public shelter system in the country, if not the world.

Construction of the tunnels starts

The new system was designed to take full advantage of the natural features by encircling the natural slope of the town at an average depth of 70 feet. The tunnels were to avoid legal difficulties by being constructed under public highways from the western undercliff near the west pier, under the streets of Ramsgate, linking up with the old railway tunnel as its eastern extremity. Tunnels were to

Postwar view of Hereson Road station on the Ramsgate Scenic Railway. The railway was closed during the war and this was also a shelter entrance.



be 7 feet high and 6 feet wide with recesses for sleeping, lavatories and First Aid facilities.

Lighting was to be provided from the town supply with back-up from batteries. Access to the tunnels was to be via ten stairways, 8 feet wide and reinforced with concrete nearer the surface. The hospital entrance was to be wider and sloped to allow easier access for patients. The harbour west entrance was direct into the cliff face and the east entrance cut into the old railway tunnel.

Despite the size of the project it was expected that only eighty people would be employed owing to the restricted work area. The Council was mindful of the employment situation for residents when planning the scheme. When a deputation was received by the Mayor and Borough Engineer from Ramsgate Unemployed Association regarding provision of labour, the Borough Engineer was pleased to inform them that Contractors were under an obligation to employ at least 80 percent of labour locally, and that they were to be recruited through channels recognised by the Council.

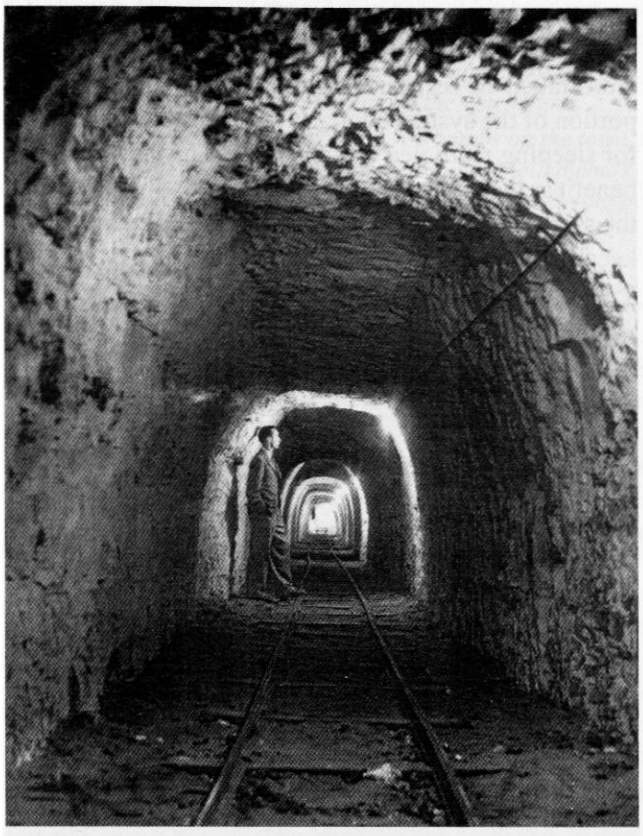
Postwar view of Beach station on the Ramsgate Scenic Railway. The railway was closed during the war and this was also a shelter entrance.

Access to the old railway tunnel was via Marina Esplanade and Hereson Road with another entrance to be constructed from Dumpton Park Drive near the Synagogue. As both the railway tunnel entrance and the harbour west entrance were facing the sea, it was fully expected that the system would have adequate natural ventilation. Work started immediately and continued 24 hours a day. But it wasn't until July that final official approval and authorisation of a 65 percent grant was received from the Lord Privy Seal, with a proviso that additional entrances and ventilation may have to be added when the results of a large-scale trial in a substantial section of the tunnel was known.

Construction methods – and readiness of the A.R.P. shelters

Construction was carried out by sinking shafts to the required depth and then heading out under the streets above. This method of construction is typical of mining practices and was used for construction of WWI A.R.P. tunnels. Removal of spoil was carried out by hoisting buckets up the shafts. A narrow-gauge rail track was installed in parts of the system and a small diesel

locomotive was used to carry spoil to the shafts. Chalk excavated during construction was deposited on the foreshore between the West Pier and Western Undercliff Promenade in anticipation of a future extension to the promenade.



A temporary contractor's railway was laid during construction of the tunnels

Work continued night and day with progress being made at the rate of 24 feet per day. The first section from the Harbour timber yard to Queen Street was opened by the Duke of Kent on 1 June 1939. This 440-yard section had been completed in just two months.

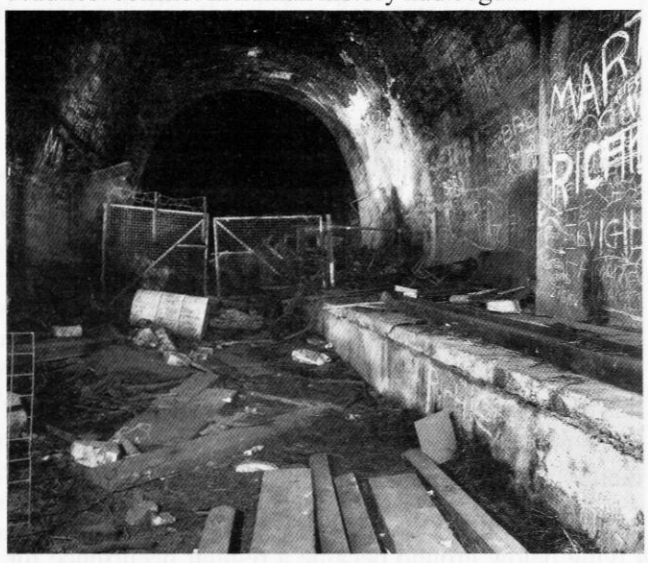
By August 1939 work had progressed around the town and the Borough Engineer reported that accommodation was available at St Augustine's Caves, Granville Hotel Caves, three of the Old Railway Tunnels and three New Deep Tunnels. Covered trenches were available at eight locations around the town.

In addition to the trenches and tunnels, Anderson Shelters were being issued; these proved very effective against blast attack, but were soon found to be very uncomfortable during the winter, and often became flooded. This led to the development of the Morrison Shelter.

In August 1939, 120 men were engaged in the delivery and erection of Anderson Shelters. Work was progressing well on the tunnels and the Borough Engineer was authorised to purchase locally as many hurricane lamps as possible for temporary lighting in the shelters. A scheme for constructing basement shelters had been rejected by the Senior Regional Officer of the Government, and revised plans were being drawn up.

World War II 1939–1945

On 1 September 1939 Germany invaded Poland. Britain declared war on Germany on 3 September and the deadliest conflict in human history had begun.



Beach Station on the Ramsgate Scenic Railway; this was also a shelter entrance

Unlike in World War I, the dangers of air raids were well understood and Ramsgate was well prepared. The reality of the situation hit the town within minutes of the declaration of war, when air-raid sirens signalled a Red Warning. This turned out to be a false alarm but provided a stark indication of what was to come as everyone rushed to the nearest available cover. This was to become a familiar procedure, not only for air raids but also for naval bombardment and shelling from nearby occupied France.

Work on completing the tunnels continued and on 8 December 1939 the Borough Engineer reported that a further seven entrances would be available but not finished in concrete.

The Home Office had by now approved plans for 170 basement shelters and was supplying the materials. By Christmas 1939 work was completed on 60 of these shelters, with the remainder to be finished within the next six weeks. Work on a Public Shelter under the Library had been authorised and was to start as soon as possible.

In his granting of permission in March 1939 the Lord Privy Seal had stated that two further sections of the proposed system required further examination before permission could be granted. No doubt mindful of the local employment situation as well as Air Raid Protection considerations, further representations were made to the Home Office regarding the proposed extensions. In a reply from the regional Technical Adviser dated 9 January 1940, it was pointed out that the accommodation which would be made available on completion of the present contract for the Tunnels would be sufficient for 32,900 people which, with further public shelter in the shape of trenches and reopened dug-outs etc. would provide

shelter for 36,587 people, which was in excess of the total population of the town. The regional Technical Adviser also noted that provision in the shape of domestic shelters had been made for a further 15,520 people and noted that:

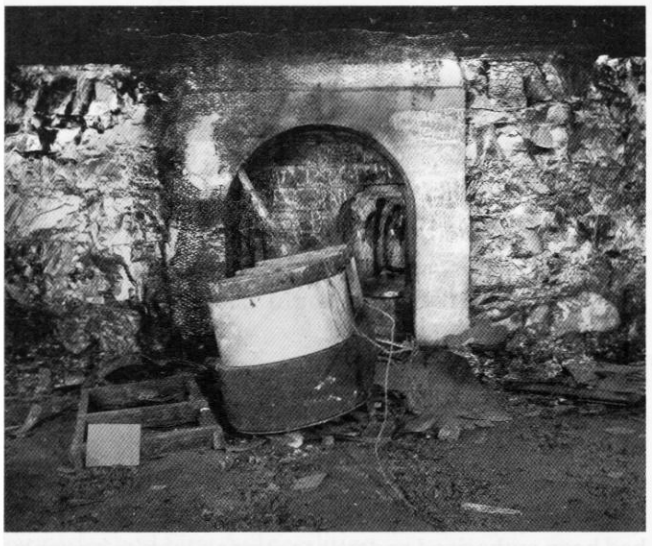
> "*... it could be better and more cheaply served by the more usual form of shelter, such as basements or trenches.*"

There was to be no further expansion of the main tunnel system for the remainder of the war.

During the Munich Crisis of 1938 residents of the Whitehall area, a large proportion of whom were miners, had commenced excavation of a tunnel which is believed to have run under the discontinued railway line of the South Eastern Railway Company, the site of which is now occupied by Hurst Grove. A considerable length of this tunnel was driven before a government order to cease work on shelters was received. It's not known if this facility was ever made available for public use.

Life Underground

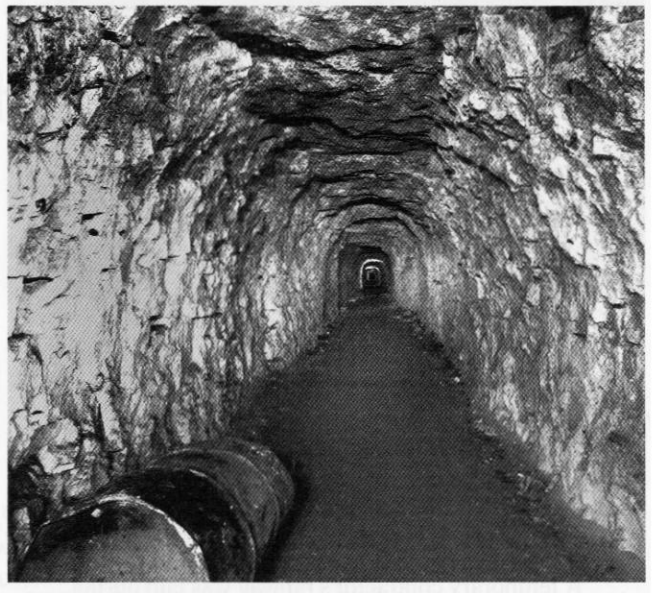
Living below ground became a regular occurrence for many. It wasn't until June 1940 that more than three thousand children were evacuated from Ramsgate to Stafford for safety. Before this, many worried mothers would take their children in the shelters for the night.



Entrance to the new shelter tunnels from the standard-gauge railway tunnel which was also part of the shelter

For those who found safety in the railway tunnel, there was the added luxury of the "World Scenic Railway" carriages. There wasn't always time to gather blankets and other items for a comfortable stay before making haste to the shelters, but for those who arrived first the added comfort of an open railway carriage was more than welcome. The mainline railway ceased in 1926 when railways were rationalised, but a narrow-gauge electric railway was installed in 1936 which linked the seafront to Dumpton via a newly constructed spur tunnel. For the amusement of passengers, illuminated tableaux were erected along the sides of the main tunnel depicting scenes from around the world. These illuminations were removed during the war but the trains remained.

For a period German bombers were arriving over the town before the sirens were sounded, which led to many people making the tunnels their home both day and night. This was frowned upon by the Council and measures were taken to restrict daytime access to a sufficient portion of the system adjacent to entrances, with access for sleeping restricted to night time. This had an added benefit as there was concern over the cost of maintaining the system. It was reportedly costing £150 per month to keep the tunnels lit on a permanent basis.



Looking west along the first section of new shelter tunnel. The standard-gauge railway tunnel is behind the photographer

Additionally, allowing use of the tunnels at all times necessitated the use of eight men to clean and scavenge the system at a cost of £25 per month. It was agreed to give control of the lighting to Police War Reserves who were continually on duty at the entrances. Lighting was only to be used during the period of a hostile attack. This would discourage the use of the tunnels except in the case of attack; this saved on electricity and allowed a reduction of five cleaners.

Ramsgate's Worst Day

24 August 1940 remains etched in the memory of anyone who was in the town on that day. Described at the time as "the world's worst assault from the air", Ramsgate received more than 500 bombs from a squadron of German aircraft approaching Manston, and 1,200 houses were destroyed or damaged. Allegedly the leading aircraft was shot down over the harbour and in vengeance the Germans decided to release their bombs over Ramsgate. On that fateful occasion countless lives were saved by the deep-shelter system conceived and implemented by the careful planning and persistence of the Borough Engineer R.D. Brimmell, his many assistants and Mayor Kempe.

The *Daily Express*, Tuesday 3 September 1940 reported:

"Mad" Mayor's new toy saves lives of his townspeople: 500-BOMBS RAID

Daily Express Staff Reporter

THERE used to be two opinions of the Mayor of Ramsgate, Mr. A. B. C. Kempe. Some called him a clown or the mad mayor. Others said the old man has got his head screwed on the right way. Now the whole of Ramsgate says one thing – he has saved hundreds of lives. Even his critics apologise and say it 'was not madness – just foresight and imagination'. For the mayor, his borough surveyor, his architect and a few friendly councillors got the best air-raid shelter in the country built before the war began.

When German airmen dropped 500 bombs on the town, smashed a thousand houses, most of the town was deep under the ground in three and a half miles of tunnelled chalk. Since this savage mass raid thousands of people sleep in the tunnels and every night the mayor goes round saying goodnight, tucking the children into their cots, assured that his population is in the safest spot in Britain.

FOR 60,000 PEOPLE

The idea for the tunnels was put before Ramsgate Council on February 2, 1938. The plan was that if there were war the tunnels would hold 60,000 people in safety and comfort. If there were no war the tunnels could be used as an underground railway to the disused harbour station. They would revive the harbour Channel trade. The Scheme got a rough ride, but was passed. It was not entirely the mayor's, but his enthusiasm pulled it through.

On June 2 the Duke of Kent was taken through the first completed of the tunnels. By September 3 they were finished. But the underground railway was abandoned. The tunnels cost £60,000; have independent electric light, ventilator shafts, and washroom accommodation. Mr. Kempe took me over them a day or two ago. They are the twentieth-century catacombs. Hundreds of people from wrecked homes were sleeping on deckchairs and mattresses, with bundles of linen and clothes they had rescued.

They all knew Mr. Kempe as he walked through, and he knew them all and their children. At first there were many who thought these tunnels were just another Kempe toy. "Now we can say there are hundreds of people here alive, who might have been dead or maimed," said Mr. Kempe. He has been in many fights in his town. First was when he was a councillor and marched into a meeting in a suit of armour, helmet and with a battleaxe. He had been rehearsing his part as Hengist in the festival. He was told to go home and change, but when the stir died down everyone knew there was a summer festival in Ramsgate. They made him mayor, and he began to publicise his town, attract visitors.

There were still critics who wanted to know why the mayor walked on the beach in a top hat, his chain, and a braided morning coat, saying good morning to the visitors. He realised that a mayor had to be dignified and a credit to his town. He gave tea for 1,000 visitors on the sands. He went bathing with a beauty queen and with a little boy from Rotherhithe who was given a free holiday for bravery.

THEY GET CREDIT TOO

There should be credit to the borough surveyor, the architect and the rest, but the real credit the town hands out is for its mayor, who carried through the idea when many said it was extravagant, and just one of the mayor's mad schemes. He is the idol of his town, and as we walked through the streets people stopped him and talked the little incidents of their lives over. I talked with one leading citizen, who said: "Oh, yes. Kempe used to clown around, but he is no fool."

No. Rather he has proved himself a man of sincerity and judgment. When he crawled out of a bombed building the other day he set about getting the town together, getting food and clothes for the homeless. He is a real city father.

Looking up the steps towards the Arklow Square entrance

The tunnels protect lives

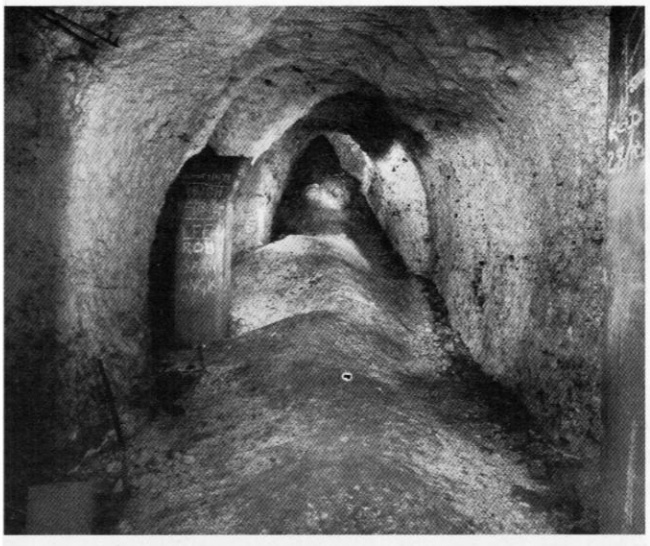
Throughout the war the deep-shelter system proved its worth on numerous occasions; nobody knows how many lives were saved. With over three miles of tunnels, more than $^{1}/_{3}$ mile of trenches, 170 reinforced basement shelters, numerous Anderson and Morrison Shelters, plus many caves and reopened shelters from the Great War, Ramsgate had the best shelter system in Britain.

"Ramsgate Has the World's Finest Shelters" proclaimed *The War Illustrated* magazine in September 1940, and many famous people visited to satisfy their curiosity. The tunnels' most famous visitor was undoubtedly the Prime Minister, Winston Churchill. Accompanying the Mayor, he was inspecting bomb damage to the town when the sirens were sounded. Mayor Kempe ushered him to the Queen Street tunnel entrance for shelter, but noticed he

had lit one of his famous cigars. The Mayor diplomatically pointed out that smoking was not allowed. As the PM smiled and threw his cigar away, onlookers rushed for the souvenir, resulting in many people getting a small piece.

As war progressed Ramsgate also suffered from naval attack and shelling from occupied France. Despite being frowned upon by the Council, the former railway tunnel became home for many. This tunnel was constructed by the London, Chatham & Dover Railway in 1864 as a dual-track railway tunnel leading to Ramsgate Harbour Station which stood on the seafront. It was 1124 yards long, 25 ft high and 25 ft wide with a brick arched roof, chalk walls and a gradient of 1 in 75.

Many families commandeered their own space in this vast expanse of the tunnel, constructing their own make-shift rooms using wood and hessian to provide a degree of privacy. Although permanent residence below ground was not encouraged, beds and basic furniture were taken down together with washing and cooking facilities. Official permission was required to sleep on a regular basis, but only in a designated place and only during specified times.



Collapsed roof beyond St. Lukes Recreation Ground entrance. The other side of the roof fall can be accessed from the Canon Road car park entrance. There are a number of other roof falls that can be climbed over but there is no air flow in this area and oxygen levels are low.

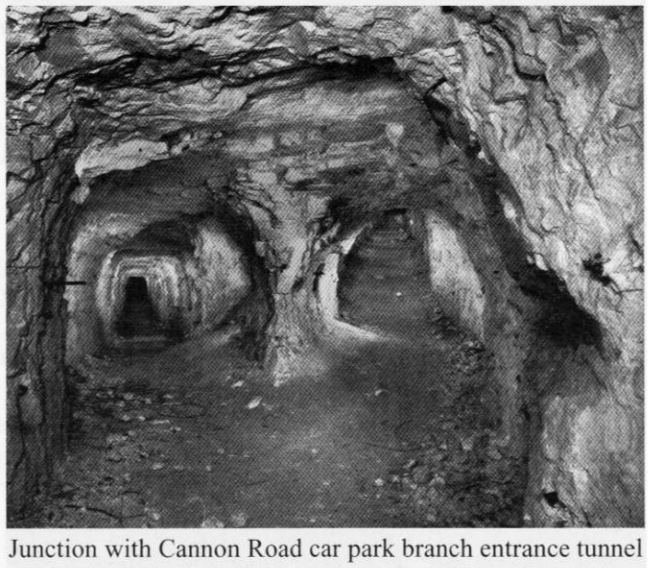
Entertainment and other uses of the tunnels

In October 1940 the council was approached regarding religious services being held in the shelters. Representations were made by Holy Trinity Church which stands opposite the Arklow Square tunnel entrance. It was agreed by the A.R.P. Committee that Rev. Culmer be authorised to conduct services in the tunnels but only if an air-raid warning should be given immediately before or during the period of services held in Holy Trinity Church. The matter was passed to the Ramsgate Council of Christian Churches for their further consideration.

The A.R.P. Committee kept a watchful eye on the shelters, which were regularly patrolled by members of the fire brigade. Despite Council policy to discourage people from remaining in the tunnels between raids, a census taken in late 1940 revealed that 957 people (324 families) were living in the railway tunnel. The haphazard way hessian cubicles were constructed presented an obvious fire risk, so the council cleared a further section of the tunnel towards the Broadstairs end and constructed new cubicles in accordance with Fire Brigade requirements. Permanent seating was placed at intervals thereby creating fire breaks. Those living below ground were moved to the new area and were required to dispose of their old cubicles.

In February 1941 a Medical Aid post was established in the tunnels and was staffed at most times by the St John Ambulance Brigade with a Health Visitor attending during the day. Also in February the Council became aware that dances and concerts were held frequently in the railway tunnel and that collections were being made. The Committee recommended:

> *"that entertainments be limited to two evenings each week between the hours of 7 and 9.30 pm; entertainment be organised and controlled by the warden; the Borough Engineer be requested to allocate the positions of any entertainment and that collections in the Tunnel shall not be permitted."*



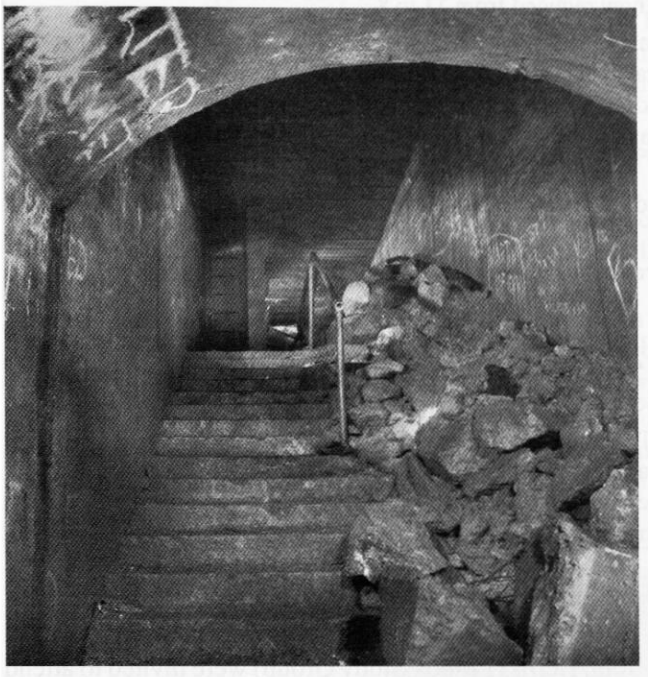
Junction with Cannon Road car park branch entrance tunnel to the right. A short distance along the left tunnel there is a T-junction with Ellington Park entrances to the right and Hospital and West Cliff Harbour entrances to the left. This part of the tunnel network now carries a sewer pipe with no access possible.

Following numerous complaints about fumes from cooking on oil stoves the Council decided to experiment with canteen facilities in the shelters. Initially trials were held at the junction of the main railway tunnel and its spur to Hereson Road, to be followed by two further facilities at the Boundary Road and Queen Street car park entrances. It's not known if these canteens were ever opened.

Such was the congestion and pollution that a plan was submitted to the Ministry for permission to construct a new entrance at the junction of Dumpton Park Drive

and Montefiore Avenue to provide a fire escape and additional ventilation. The plan was refused with the Government Inspector suggesting an additional ventilation shaft instead.

Toilets were placed in recesses at intervals throughout the network. At the start of the war Margate Corporation loaned the Ramsgate a horse-drawn "mud drum" to remove waste. This was free of charge until 1941 when the Corporation asked Ramsgate for a weekly hire charge of 2 shillings and six pence (12˚p), which they agreed to pay.



Cannon Road car park entrance. This is one of the few remaining access points into the tunnel network. There is a securely locked manhole cover at the top of the ladder on the left.

The end of World War II

At the cessation of war, entrances to the tunnels were closed and the system fell into disrepair apart from the section from Ellington Park to the Harbour. By 1950 a large sewer pipe was installed in part of the system under Ellington Road and continued down to the Harbour. At the Ellington Park end the pipe almost fills the tunnel, but as it progresses toward the harbour it slowly disappears into the floor, leaving the tunnel system intact. Many smaller shelters were abandoned and covered over. The local authority removed Anderson Shelters, although householders could retain them on payment of a nominal fee.

The Cold War 1947–1991

It's well known that history repeats itself and preparations for wars are no exception. In 1949 Russia tested its first atomic bomb and in 1950 President Truman approved development of the H-bomb. By 1952 Britain was developing atom bombs. The Cold War was well under way.

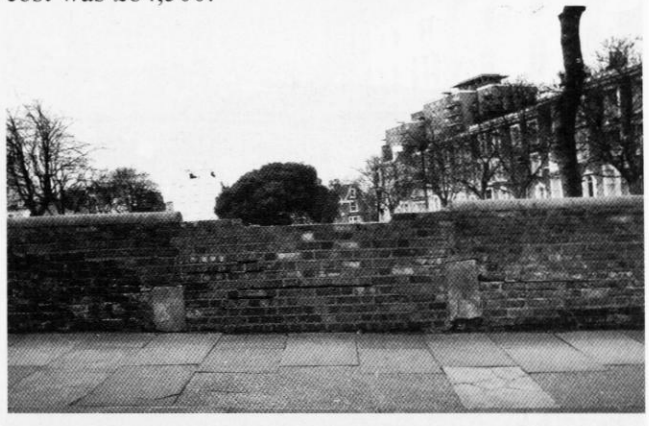
As in WWII, the British authorities became concerned about the escalating situation and plans were drawn up to protect the public. Little was known about Ramsgate's plans until confidential government records were opened in 2008. Again, Ramsgate's Borough Engineer R.D. Brimmell was ahead of the game and in January 1951 he produced a plan to reopen and reinforce the existing A.R.P. tunnel system from WWII. In addition to this, a plan was developed to construct new tunnels with access points covering the expanding town. The plan was divided into three schemes:

Scheme I was to widen a section of the existing A.R.P. system which was partly blocked by the sewer pipe. This scheme would serve 10,000 people, and would include 1,500 yards of the tunnels. The cost was estimated at £16,500. Included in this figure was the cost of reopening the remainder of the existing network.

Scheme II was for a new 700-yard tunnel to be dug under London Road from Pegwell Road to Nethercourt with an entrance at each end. This would serve 4,010 people at an estimated cost of £15,500.

Scheme III was to serve the Newington area and was by far the most ambitious. The tunnel would be 2,850 yards long (1.62 miles) and would serve 10,250 people. The total estimated cost was £52,500.

The three schemes would make available more than 4˜ miles of tunnels for almost 41,000 people living or working with a ˜ mile radius of an entrance. The total estimated cost was £84,500.



There is little evidence of any of the entrances on the surface. The Arklow Square entrance was between the two stone pillars. A change in the brickwork clearly shows where it was.

It wasn't until 1954 that central government took an interest, when the Ministry of Works carried out a survey of the existing tunnels for reservation by the Home Office as air-raid shelters. See Panels. Although no documentary evidence can be found, it's widely believed that the Cold War proposals were never adopted.

As development of the town continues, more of the long-forgotten WWI tunnels are being discovered and the WWII tunnels remain under Ramsgate largely as described in 1954.

A survey (1954) of the chalk tunnels reported the following:

Class of Property: The tunnels were cut specially for the provision of air-raid shelters during the war.

Access: There are 11 entrances, (not all usable). They are situated at various usable points in the district and consist of flights of steps leading down from street level. The steps are well constructed in reinforced concrete. They are not roofed over, but are open at the top and railed round to protect the public. In addition to the street entrances the tunnels were originally connected to the old railway tunnel; but the connection is now blocked. This connection could be reopened.

Description: The tunnels have been cut in chalk and are 6 feet wide by 7 feet high. They are neither lined nor propped. Since the war, a considerable length has been used to accommodate a sewer. In this length the headroom is now reduced to about 3 feet high and it is only sufficient for the tunnel to be used for ventilation and for crawling through in an emergency. Consequently, the number of useful entrances is now reduced from 11 to 8.

In general, the tunnels are in good condition and dry. In normal circumstances, heavy roof falls are unlikely to occur but there has been a considerable fall over a length of about 60 yards. This was due to the bursting of a water main above; otherwise only light spalling has occurred. In tunnels of this kind, the flatness of the roof, together with the percolation of water, tends to produce spalling and light falls over a number of years, until the arching of the roof becomes stabilised.

Ventilation: Ventilation is natural between the entrances and by three shafts. It is understood to have been adequate during the war.

Services: Electricity, gas and water are available from the streets above. The tunnels have been wired for electric light but the installation is no longer serviceable.

Vulnerability: The overhead cover consisting of chalk is from 50 feet to 75 feet deep over the tunnels, and provides an adequate degree of protection against random bombing with 500 pounds and 1000 pound medium-capacity bombs. In the case of direct hits, a 500 pound bomb would not be expected to damage the tunnel, but some spalling would be expected if the bomb was a 1000 pound medium-capacity type and the overhead cover was less than 60 feet.

Recommendations: The tunnels are suitable for use again as air-raid shelters, but before making use of them, a detailed examination of the roof should be made by a competent tunnel miner and all loose pieces of chalk should be removed. If the shelters are to be fully occupied for long periods, some mechanical ventilation may be found necessary. The usual services and amenities should be provided.

Nick Catford of Subterranea Britannica was invited to join members of Thanet District Council at the Cannon Road Car Park entrance during an inspection of the tunnels in 1996. At this time there was a proposal to open the tunnels. The fire brigade were there in case of any H & S issues.

History since 1974

Custody of the WWII shelter system passed from Ramsgate Borough Council in 1974 and the current guardians are Thanet District Council. In 1996 the Council held a series of meetings to discuss possible future developments; this included a visit to a section of the tunnels by members of Thanet District Council and Kent Fire Brigade. Nick Catford (Subterranea Britannica) and John Hellis (Pillbox Study Group) were invited to attend as consultants. In 1997 a survey of the Cannon Road to East Cliff sections (including the railway tunnel) was carried out. Although this report didn't expose any major safety concerns, the idea of opening them to the public was shelved.

Residential developments over recent years have permanently sealed the Hospital and St George's School entrances, but other entrances remain covered over with concrete slabs just a few feet below ground. Four entrances remain clearly visible. These are the harbour entrance opposite Southern Water's facility near Jacob's Ladder; the railway tunnel entrance in Marina Esplanade; Townley Castle entrance in Chatham House School's car park on the corner of Chatham Place and Boundary Road; and at Boundary Road Recreation Ground where concrete slabs can be seen covering steps down into the system.

Access to the tunnels

Generations of "urban explorers" have been unable to resist the temptation to explore this important but discarded piece of history. They have continued to gain access by fair means or foul, and such was the airflow in the tunnels that they became known as the "Wind Tunnels". In recent years attitudes to safety have changed and "counter measures" have been put into place to prevent unauthorised access. All entrances are now

A similar survey (1954) was carried out on the disused railway tunnel:

Description: The tunnel is an old double-track railway tunnel and was used as an air-raid shelter during the war. It runs approximately north from the Amusement Park on the seafront to the Greyhound racing track, and is at present used for running a miniature electric railway in connection with the amusement park. The tunnel is about 25 feet wide, 25 feet high, 1500 yards long and passes under a closely built-up area. In addition to the two open ends there are two entrances in branch tunnels 8 feet 6 inches wide by 8 feet high. These two are provided by reinforced concrete steps leading from Hereson Road and Dumpton Park Drive. The steps are provided with a centre handrail and are in good condition.

During the war there was an opening to a branch tunnel near the southern end of the main tunnel. The opening led to other tunnels specially constructed as shelters. It is now blocked but could easily be reopened. The whole of the tunnel is usable and approximately level. The roof is lined throughout with a brick arch but the sides are only lined in places. Where the walls are unlined, some scaling of the chalk has occurred; particularly near the southern open end. This is probably the effect of damp and frost as frequently found near the entrances of unlined tunnels of this kind. The floor is covered with a layer of sand and the tunnel is dry. Ventilation is natural and the atmospheric humidity is not as high as usually found in disused tunnels.

Services: Gas and water mains and a sewer are available at the ends of the tunnel. Electricity is available inside the tunnel.

Vulnerability: The overhead cover consists mainly of chalk from 75 to 100 feet in depth. This is adequate overhead protection against random bombing by 500 pound and 1000 pound medium-capacity bombs, but the open ends of the tunnel will need to be protected with blast walling.

Recommendations: The tunnel is suitable for use again as an air-raid shelter. The open ends will require to be built up with reinforced concrete walling of a more substantial construction than that usually required for blast walls erected in the open. Entrance openings should be left in the end walling and protected by blast walling.

The tunnel could accommodate about 6000 people in bunks; but the entrance facilities fall somewhat short of what is desirable for so many. The construction of two or three more branch tunnel entrances would be advisable. If the tunnel is to be occupied as a shelter, the existing natural ventilation will be insufficient and mechanical ventilation will be necessary. The usual services and amenities should be provided.

substantially sealed which has greatly restricted the airflow. Without proper ventilation, Ramsgate's greatest asset during the war is set to become a peacetime liability.

2011 – The Ramsgate Tunnel project

In order to try and facilitate reopening of the tunnels as part of Ramsgate's heritage, the Ramsgate Tunnel Project was established in 2011 to fully research and document the history of the tunnels, a very important part of which is to record oral histories of those that used the shelters during the war. Documents and statistics are available, but the personal memories will really bring the project to life.

The Ramsgate Tunnel Group received a grant of £53,000 in July 2011 to help with the proposal to reopen the Ramsgate tunnels to the public.

At the same time the group will be commissioning surveys to establish the current condition of the tunnel network. This will lead to a feasibility study and viable business plan which will look at all options to establish a heritage attraction and educational resource that will inform and entertain residents and visitors alike.

The Ramsgate Tunnel Group once again called on the fighting spirit of the town on 27 June 2011 when voting for funds in the Jubilee People's Millions, and, true to form, the town won through with an incredible amount of support. The Group now has a grant of £53,000 from ITV/Big Lottery Fund which will allow work to start on the tasks ahead.

Current thoughts on the future of the tunnels

It's envisaged that the Railway Tunnel will be used for the heritage attraction and at over half a mile long there's certainly no shortage of space. It's also envisaged that one or two of the original entrances to the chalk tunnels leading off the railway tunnel will be reopened and guided tours will take visitors through reconstructions and animations of life underground. This is an ambitious project in the current economic climate, which is similar in many respects to 1939 when the eccentric "Top Hat" Mayor of Ramsgate, Alderman Kempe, gained permission to build the tunnels against Government policy. The spirit of Ramsgate has a way of dealing with these things!

The tunnels are generally still in good condition. Chalk-cut sections and concrete-lined entrances are still hidden below ground and will provide a perfect setting for reconstructions, displays and tours depicting life through this most important part of the town's history. The former mainline railway tunnel, built in 1863, is over half a mile long and will be the perfect venue to preserve and present the town's history. The coming of the railways to Ramsgate was another very important time as it brought wealth and prosperity to the town.

The Ramsgate Tunnels Project is focused on researching, collating, archiving and presenting the history of the tunnels. Funding will be made available to train volunteer members of the community in researching, interviewing, recording, cataloguing and archiving all aspects of the tunnel's history. There is now a great opportunity that Ramsgate's tunnels will be open once again to thousands of people to explore their past.

For more information see the website:
www.ramsgatetunnels.org

All recent photos by Nick Catford taken in August 1984 or January 1997 unless stated.

Nick Catford has written a book about the tunnels "The Ramsgate Tunnels: Mainline Public Air Raid Shelter & Scenic Railway" available from Amazon.

Sub Brit Members' Questionnaire Results

By Mark Russell

The Sub Brit questionnaire which ran earlier this year has been a great success. The form was issued online to all those with email access and we issued hard-copy forms to those without.

Over five hundred returns were made – astonishingly over half of all members – meaning the results are representative of many rather than a few. The results were discussed at the committee in June and will be key in helping determine our future direction.

Forty-three percent of SB members first heard about Sub Brit from our website but this shows that other sources – media, word of mouth and other websites – are still crucial.

Members' Interests

Cold War sites were chosen top of members' interests, with WWII and Transport in second and third places. However, even the lowest-rated site types – Mines & Quarries – still showed that 59 percent of members are Very or Quite Interested, indicating that all site types are popular. Feedback will help shape the mix of articles for *Subterranea* as well as help the balance of new sites to be visited and recorded.

A massive 97 percent voted *Subterranea* as Very or Quite Important. This was gratifyingly matched by 96 percent who were Very or Quite Satisfied with our publication. Areas where members' satisfaction "lags behind" their assessment of importance include Site Visits, Longer Trips and 'Hands on' activities. These are areas for us to focus on improving for the future.

Website

Given today's digital age, it is not surprising that 89 percent of members view our website as Very or Quite Important. It is reassuring that after the recent refresh, a Satisfaction level of 86 percent was achieved. Work to enhance the website is ongoing and the interest in future content and capabilities will help us prioritise developments.

The three top features requested are: more UK site records, an Online Shop and a Members' Web Forum. There was comparatively little interest in social networking or replacing a printed copy of *Subterranea* with just an online version.

Conferences

With regards to our Autumn Day Meetings/Conferences, London is the preferred location of over fifty percent of members (remembering that our policy is to always hold Spring Meetings and the AGM in London). The South and North of England were each voted first choice by just under twenty percent of members, and below five percent preferred Scotland or Wales.

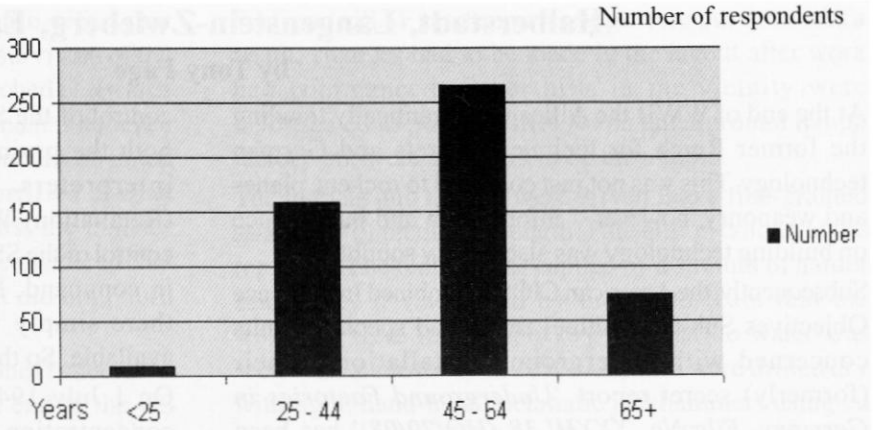
Over 80 percent of you would like to see the conferences combined with an occasional site visit. Underground sites that can accommodate 100+ attendees from a conference are not that common but we are responding to these results by planning a Conference Day in Liverpool in Autumn 2012 with an associated site visit.

Value

A massive 96 percent of you viewed our current subscription levels as Very Good or Good Value, with no one at all choosing Very Poor Value. This is very pleasing to see and an incentive for all whose hard work contributes to making Sub Brit what it is to continue to do so.

Being involved

Finally, thank you to almost two hundred members who indicated that they may be able to contribute to Sub Brit's future by writing, organising, presenting, guiding etc. In a voluntary organisation such as ours, we rely on the hard work from members to keep the society as successful as it is. We will use this information (where we have the names) to contact people for specific activities over the coming months.



Age profile

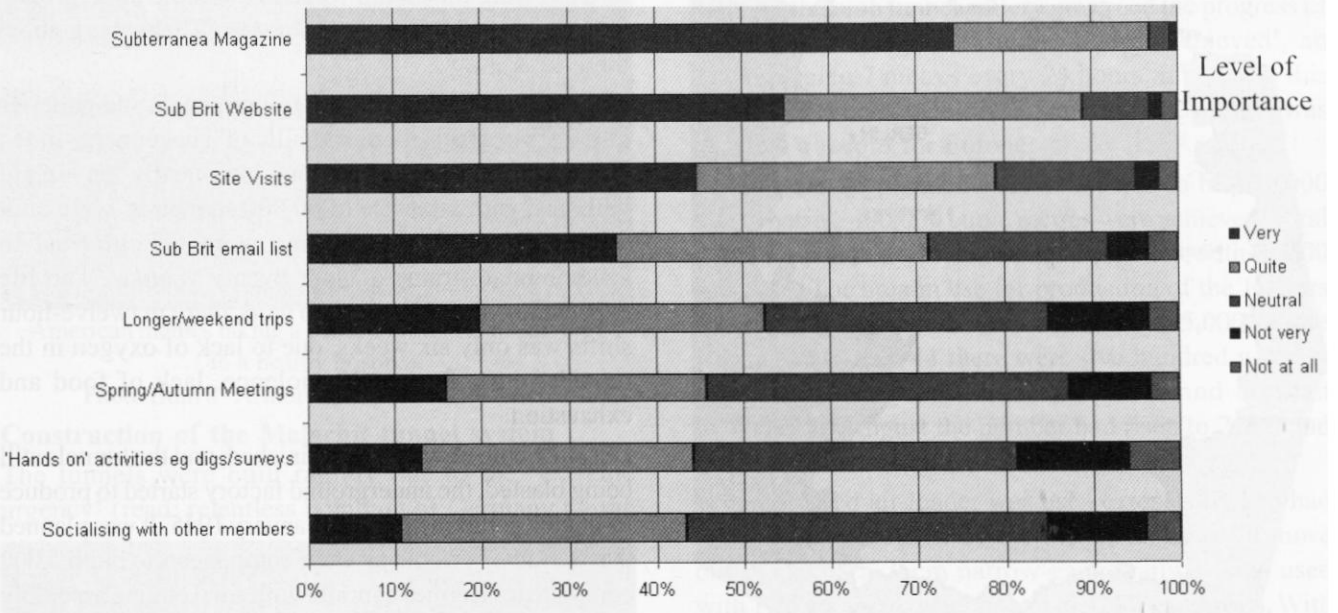
Details

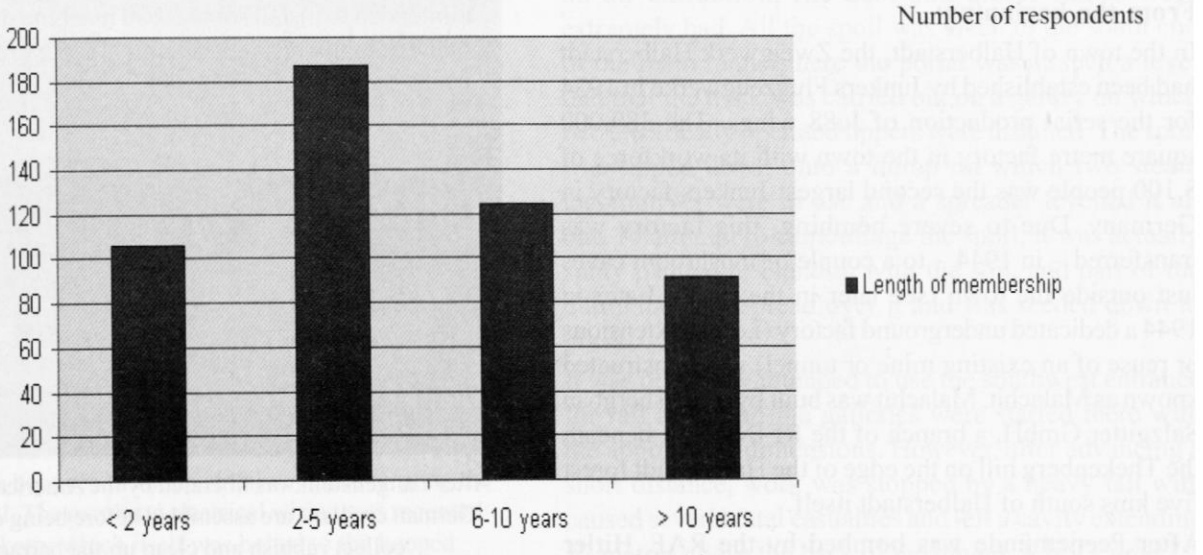
For anyone who wishes to see more of the results, they are available on our website at

www.subbrit.org.uk/docs/survey2011_results.pdf

The random draw for a Sub Brit fleece from those who completed the questionnaire was made after entries had closed. Congratulations to Brian Hoggard of Worcester who should now be a little warmer on future Sub Brit trips.

With thanks to Martin Dixon who led the design of the questionnaire and Linda Bartlett who helped with analysing the results.





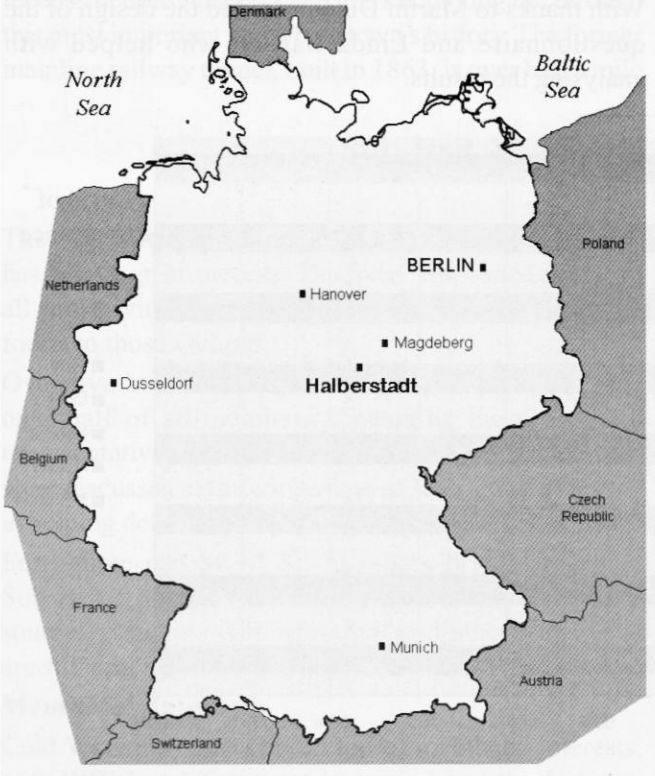
Length of Sub Brit membership

Halberstadt, Langenstein-Zwieberg, East Germany

by Tony Page

At the end of WWII the Allies were frantically trawling the former Reich for technical secrets and German technology. This was not just confined to rockets, planes and weaponry, however – information and intelligence on building technology was also keenly sought.

Subsequently, the American CIOS [Combined Intelligence Objectives Sub-Committee] teams had specialist units concerned with underground installations. Their (formerly) secret report *'Underground Factories in Germany, File No. XXXIII.38 (HO/79/08)'* has been in my possession for many years and Halberstadt's huge 17 km former Nazi underground factory was a 'site of interest' not only to the US CIOS teams but, later on, in the next conflict – the Cold War.



From the beginning:

In the town of Halberstadt, the Zweigwerk Halberstadt had been established by Junkers Flugzeugwerke in 1934 for the serial production of Ju88 wings. The 389,000 square metre factory in the town with its workforce of 8,100 people was the second largest Junkers factory in Germany. Due to severe bombing, this factory was transferred – in 1944 – to a couple of mushroom caves just outside the town (see later in the text). Later in 1944 a dedicated underground factory (i.e. not extensions or reuse of an existing mine or tunnel) was constructed known as Malachit. Malachit was built by the Ersbergbau Salzgitter GmbH, a branch of the REIMAGH, beneath the Thekenberg hill on the edge of the Halberstadt forest five kms south of Halberstadt itself.

After Peenemünde was bombed by the RAF, Hitler ordered all secret weapons plants to be placed under the control of the SS and located underground – safe from both the prying eyes of the RAF and photographic interpreters. Secret and V- *Vergeltungswaffen* (Retaliation) Weapon production were put under the control of the SS with Obergruppenfuhrer Hans Kammler in command. Kammler's problem was, however, that there simply weren't enough underground places available. So they were built...

On 1 July 1944 a special sub-camp of Buchenwald concentration camp was set up in the forest near Langenstein. The first 18 KZ inmates arrived from Buchenwald on 21 April 1944 to set about creating the sub-camp. Initially billeted in an inn then, later, a barn, the camp took shape as more and more KZ inmates arrived to find seven wooden accommodation blocks within an electrified enclosure. Eventually there were eighteen blocks housing over 7,000 inmates. The luckless inmates were the labour force to build the underground aircraft engine factory in the nearby Thekenberg about three kms away.

The deportees set to work digging tunnels and galleries in the still virgin site of the hills of Thekenberg. In ten months, with a terrible attrition rate, nearly ten kms of galleries, with a surface of 60,000 sq metres, were built and partly completed. Some were enough vast to accommodate trains of over twenty wagons. The life expectancy of those forced to work there in twelve-hour shifts was only six weeks, due to lack of oxygen in the tunnels, dust, fumes, SS violence, lack of food and exhaustion.

Despite being nowhere near finished, and the tunnels still being blasted, the underground factory started to produce jet engine components on 14 January 1945. It was planned that the factory would produce components to build 1,000 complete jet engines a month with final engine assembly carried out at the Junkers factory at Zittau. Originally, it was intended to install some 3,000 machine tools but only 230 had actually arrived, of which 125 were wired up

After Langenstein was liberated by the Americans in 1945, German civilians are assembled before being detailed to collect rubbish and clean up the barracks.
Photo from 8th Armored Division Association

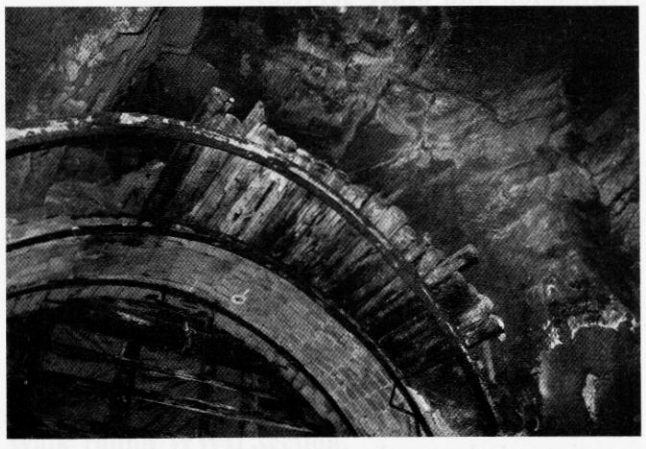
On the evening of 9 April 1945 as the US Army approached and reached the Elbe, 3,000 survivors of the camp, in six separate columns, were marched eastwards by the SS. Most were murdered en route and it is believed that only five hundred survived. The Americans liberated the camp on 13 April 1945 and were horrified at what they found. Despite their best endeavours, the inmates still died at a rate of twenty a day. It is considered that 75 percent of those deported to Malachit did not return home [Tracing Service, Arolsen].

The Russians arrived to take over on 30 June (Halberstadt was in the Russian Zone) which put an end to the US inspection of the site. At the site of the former camp a memorial and a commemorative plaque were inaugurated on 11 September 1949. In 1976 (GDR times) a museum was created within the grounds of the Memorial of Langenstein-Zwieberg.

American medics taking a concentration camp survivor to a nearby hospital.
Photo from 8th Armored Division Association

Construction of the Malachit tunnel system

The tunnels were built rapidly due to the 'extreme urgency' (read: relentless bombing of Germany by the RAF and USAF) and so no borings were put down. As a result, changes had to be made in the layout after work had commenced. Other hills in the vicinity were investigated as possible sites for an underground Krupp factory but were all found to be unsuitable.



Showing the stages of tunnel construction: rough cut rock, wooden poles, railway line hoops, bricks. It is thought that the wooden poles protected the tunnel brickwork from damage caused by lumps of rock falling down. Then bricks were laid in between the hooped railway lines creating the tunnel wall. The overhead electrical wiring was mounted on bracketry which itself was bolted to the hooped iron railway lines. Photo Tony Page

The tunnels into the hill were driven into a fine-grained sandstone of medium strength. Pale buff in colour, at the top of the Thekenberg it is capped by a stratum of harder sandstone. It was noted by the CIOS team that the workings were remarkably dry and that no water was seen – the same today in 2010. All holes were drilled dry with light, hand-held pneumatic jackhammers using an auger steel with a chisel bit. Electric drills were tried but were unsatisfactory. Light pneumatic picks were used extensively for trimming the roof sides [former KZ inmate testimony].

There were two sizes of tunnel: 7 metres wide by 5 metres high, and (as the main north/south galley) 4.40 m wide by 3 m high. According to the CIOS interrogation report of Herr Heese and his No.2 Herr Luder, progress in this main north/south tunnel gallery governed the progress of the whole project so 'faster work was achieved', an average being 7 metres every 24 hours. It states in this report that an advance of 17.5 metres in 24 hours was reached, a record for Europe.

In 1944 the SS planned excavation was to be 450,000 cubic metres; 400,000 cubic metres were achieved. Total floor area planned was 72,000 square metres, with 67,000 achieved. The area in use for production of the Junkers jet engine components was in fact only 25,000 square metres. In June 1944 there were five hundred workers (made up of forced labourers, PoWs and civilian workers); by August the number had risen to 2,000 and by November to 4,500.

A compressed-air loader was used extensively and had a maximum output of 21 cu. metres an hour. To move out the spoil, a 75cm narrow-gauge railway was used with 1.25 cu. metre wagons and diesel locomotives. With no air-extraction, the dust and diesel fumes were extremely bad. All the spoil was taken to the south end of the main tunnel; here the portal was at such a level that that the track was carried out on a gantry on which two electrically operated tippers were installed. The spoil was tipped down onto a dump on which two steam locomotives were in use and a spreader levelled it all out. To attempt to camouflage the spoil, it was actually spray painted to blend in with the soil, and part of the dump had soil spread over it and was seeded down to grass.

It was originally intended to use the southwest entrance for rail access so the galleries were started there with the appropriate dimensions. However, after advancing a short distance, work was stopped by a heavy fall with caused several fatal casualties and left a cavity extending 12 metres above the back of the tunnel. A brick arch 1.5

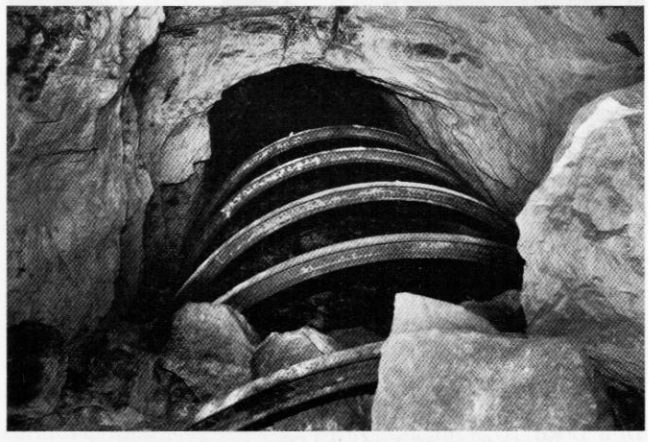
One of the main tunnels. Note the hooped construction and the arched railway lines used. Photo Tony Page

metres thick was constructed for a length of 12 metres at the point affected. The intention to use this gallery for rail access was abandoned and its dimensions were reduced for the remainder of its length. A CIOS inspection showed the cause of the fall to be a stream of very weak sandstone overlying the gallery. Two of the entrances had railway lines entering 110 metres into the tunnels for incoming stores.

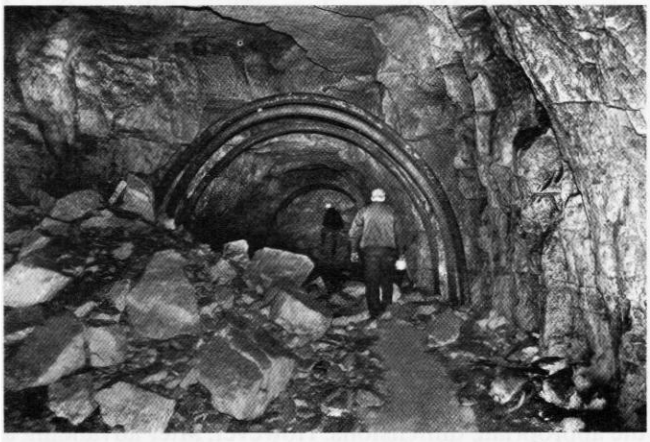
The original SS plan shows that it was intended to line the workings throughout. Indeed, today it can be seen that considerable progress was made. Several types of lining were used but these were all based on steel ribs of heavy H-Section 12cm x 10cm placed at 1m centres. The four types were:

- Pre-cast slabs of concrete 1 metre and 22.5 cm deep placed between steel ribs
- Two pre-cast slabs each bearing on a steel rib at one end and on a central concrete voussoir (wedged-shaped units that are used when building an arch) at the other
- Brick lining between the steel ribs
- At the junctions of tunnels and galleries where the rock was weak, brick arches of heavy construction were used instead of steel rib construction

In all cases, the lining was backed with stones set in cement mortar. From 1945 steel ribs became difficult to obtain and instead of building them in, they were used as supports for shutters to a mass concrete lining. These shutters were of 25mm board, 225mm wide and one metre long wedged off the ribs. The concrete was 40cm thick to springing reduced to 10cm at the crown of the arch. Stone was hand-packed behind it where necessary.



Clambering over yet another roof fall (note the size of the chunks!) gave a useful perspective on the German tunnel construction method. Photo Tony Page



Roof falls, hooped railway lines showing how the tunnel would be finished, and all but blocked at the end. Thorsten Hintze examines the rubble while Sascha Keil advances. Photo Tony Page

Ventilation and other services

Seven air shafts were sunk outside for ventilation purposes. However, the permanent ventilation intended for this factory was never installed. The basic concept appeared to have been to provide a simple mechanical fresh air supply, and extraction, the incoming air being warmed but not filtered or otherwise treated. The fresh air was to be drawn in from the surface down the ventilation shafts, with fans and heaters at the base.

Ducts beneath the floors of the main tunnels and galleries would provide the air. These outlets were arranged so as to project warm air along the length of the cross tunnels with an upward bias. It was stated that the ventilation rate intended was three air changes per hour. A temporary exhaust fan was installed right outside one tunnel entrance which operated in conjunction with three of the vertical fresh air inlet shafts – a temporary arrangement which, according to statements given to the CIOS team, were just hasty improvisation and unsatisfactory.

One of the ventilation shafts. Photo Tony Page

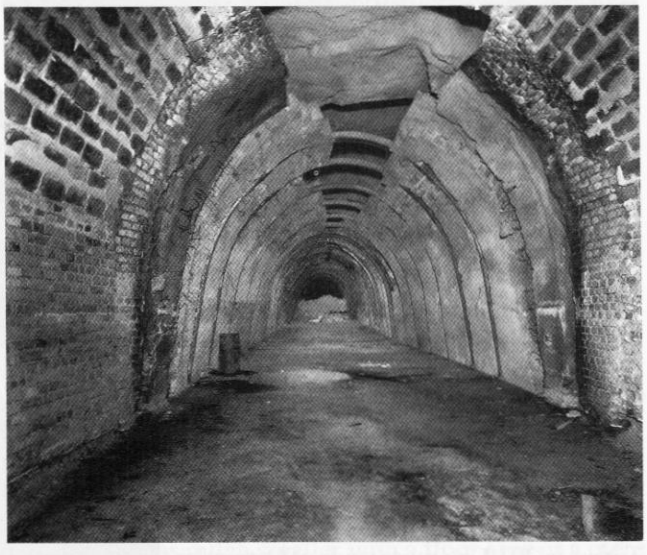
There was also a shaft dug inside the installation to draw water up from the sands below, plus five wells dug outside with depths varying from 40 to 46 metres. Three were in use and yielded 40,000 litres a day. Salt-glazed pipes laid in trenches beneath the main tunnel carried sewage away by gravity flow to a septic tank discharging to the river. In order to enable the first completed tunnel section to be used for production, a temporary heating installation consisting of four cast-iron boilers were installed in a building on the hill outside next to one of the ventilation shafts. Junkers (!) hot water heaters were used, but the whole thing was of a very temporary character and basically useless according to the CIOS interrogation notes.

There was electric lighting and the incoming power supply was received via high-tension cables from the grid system and then transformed on site to working voltages of 380/220 volts. The cabling for power and lighting ran beneath the floor in a central duct or alternatively along the tunnel walls in special U-shaped clips welded to the top of the compressed air main. Most of the lighting was by double one metre fluorescent tubes every six metres, with some metal-filament bulbs too.

Internal and inter-bay transport was by accumulator-driven floor trucks. There was no lifting gear anywhere in the factory, as generally the weight of the components rendered this unnecessary. No conveyor system had been installed either, yet this would have been required in order to move the components along to the next work station. The CIOS team concluded that there appeared to be 'undue haste' to get in production with whatever machines could be obtained or transferred from other Junkers factories, and that the speed to get into production had overridden all other considerations.

Walk round WWII section.

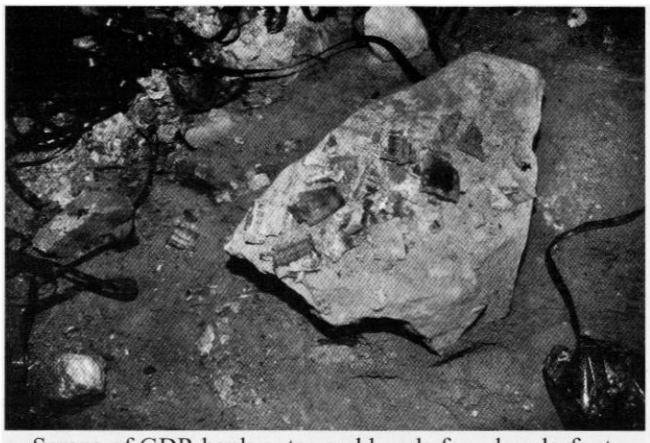
Having been on the first Sub Brit trip to Malachit back in 2003 but being unable to fully explore the abandoned World War II side at all, I had jumped at the chance of this return trip. Back in the early noughties, Dan McKenzie and I had been offered entry into a former WWII (my interest) and NVA (Dan's interest) bunker in Halberstadt. I had been researching and visiting the various former WWII underground weapons factories built by the Nazis for years, and Halberstadt was on the list. Wilm Wolf had contacted us and indicated he could get us in 'various sites' on my list. I got on the case and we exchanged info, and Halberstadt came up. Back in 2003 having driven a mile or so into the former base basically into the side of a mountain, there was a cranked entry road, with very high sides of rock. At the end of this approach road was a camouflaged heavy door, protected from prying airborne eyes by heavy camouflage netting. The place then still resembled an active bunker.



WWII tunnels in 2003; in this part of the tunnel network little has changed. Photo Nick Catford

We had driven our cars in through this entrance and into the mountain itself. The tunnel was huge, accessible by trucks. We'd waited while our guide opened a very secure inner door; again a massive four metre high hydraulically operated steel structure. Once inside, we drove along countless huge tunnels in perfect condition, marvelling at their size. This was a first for me - driving at quite high speed through long road tunnels inside a huge bunker. We came across the main railway line and a very, very, long platform for unloading supplies. At a whisker under one kilometre, it was said to be the longest platform not just in any bunker in Germany, but in Germany itself! The rail connection from the main line had been lifted some years back, so it was no longer possible to run trains inside the complex. The tunnels were in perfect condition: dry, well ventilated and clean. The walls were faced and painted, the floor perfect.

But now it was 2010. This time we entered the system through a different entrance, the one close to the 950 metre railway platform. The railway had been lifted but traces could still be found. Sascha and Thorsten from Berlin Unterwelten were our ticket in on this occasion as we drove our rental cars into the tunnels. Sascha knew of my past interest in Malachit and as we needed to keep in teams for safety considerations, Sascha, Thorsten and I became one. Our particular mission was

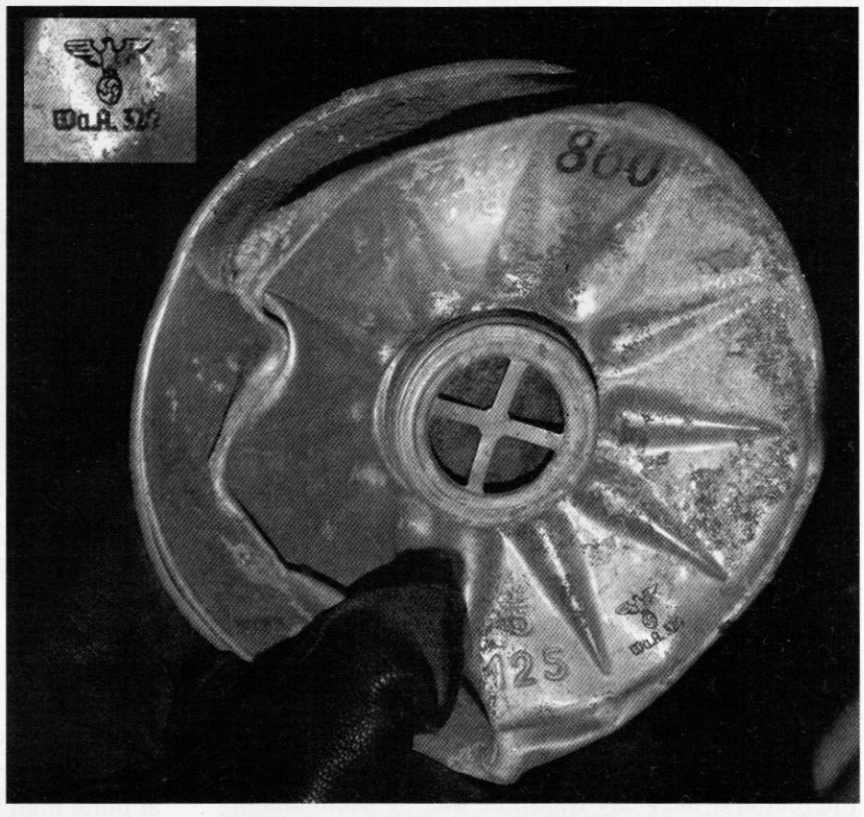


Scraps of GDR bank notes and bonds found underfoot.
Photo Tony Page

to be the abandoned WWII side of Malachit. We had two days to explore the system and maps to facilitate this. As we walked off down one of the huge tunnels into the darkness I remembered coming across a small wad of Ost Marks on our previous visit. Just lying in the sand had been a small torn wad of EM10 notes. Unbelievable. A tangible link with the past and a weird feeling - as it proved it had really happened. Okay sure, we all knew it had, but to hold it in your hand brought it home with a start.

Today, in 2010, no more wads of Ostmarks but there are still shreds and tatters of notes and banding lying around. As we progressed further and further into the abandoned side of the complex it became obvious that it wasn't the safest place in the world to spend a weekend. Evidence of recent roof falls were everywhere and as we clambered over what was previously the ceiling, we thought it prudent to keep well apart and to keep our voices low. Using an old CIOS map, we walked and walked, finding tunnel after tunnel and gallery after gallery. The air intake for the NVA complex actually used a part of the abandoned WWII side so at one point we found ourselves deep within the WWII area but next to a finished, grey painted NVA wall. Very strange.

As we approached the edge of the complex (according to our map) we discovered an emergency exit. It was rough cut and unfinished and still had the wooden pit-props in position. As it progressed outward, it got smaller and smaller necessitating a serious crouch by the end. Drill bits protruded from the rough hewn sides of the small tunnel, no doubt left there as the plans for world



Nazi gas mask filter found on the floor.
Photo Tony Page

domination were rapidly revised by those in charge. Lying around on the rocks which made up the floor, we found gas mark respirators with WWII German markings.

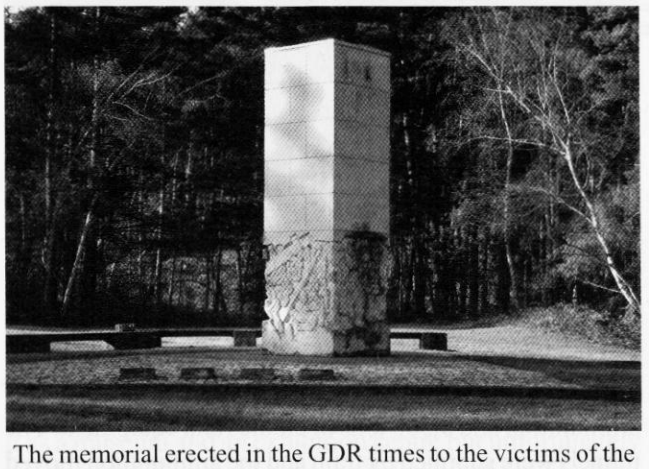
The tunnel system is extensive and we endeavoured to walk it all. Some of the tunnels are lined, some not. The standard and overall build quality was good in the finished areas, and everywhere was dry. There were, however, countless roof falls which impeded progress. The impression gleaned from walking the system leaves one in no doubt that this factory was to be very big indeed. With tunnels stretching deep into the mountain, safe from Allied bombers, Malachit was a massive undertaking.

We found the occasional lamp, overhead wiring, shelf, cable-fixings and so on from the WWII period but nothing major save the tunnels themselves. Using our map we found the one internally-bored well. Also dotted around

Unfinished tunnel leading to one of the ventilation shafts.
Photo Tony Page

the abandoned tunnel complex are smaller exploratory side tunnels dug off perpendicularly at waist height. Usually around one metre square and reaching in two or three metres, these were apparently dug in the 1970s and 1980s by, of all people, the Stasi who had created a special unit specifically to search for ex-Nazi loot. Acting on information obtained from interrogated subjects – often former Nazis – the unit would search for stashed treasures.

As our visit to Malachit was over Remembrance weekend, having stood still in silence at 11am English time deep beneath the mountain in the tunnels hewn by countless victims of yet another war, I thought it fitting to present myself at the KZ Memorial at the site of the former camp of Langenstein-Zwieberge with my poppy. Finding myself locked inside the perimeter fencing of the former NVA base, I negotiated the 2m fence (topped with three strands of barbed wire) and yomped off in the direction of the camp 'about 1km down the track' as Sascha had assured me. However, 200 metres down the track was another fence, this time 2.5 metres high and topped with razor wire, but this too was successfully by-passed without drama. The KZ site was actually four kilometres away along muddy tracks but I made it just in time. There is a large memorial and a few remnants of the concentration camp plus a small museum. After paying my respects I retraced my steps (up and over the two fences…) and returned inside the mountain.



The memorial erected in the GDR times to the victims of the concentration camp Langenstein-Zwieberg who were forced to construct the tunnel system. Photo Tony Page

Post-WWII

After the war, the complex was left open. The Russians were not interested in it as all the jet engine components had gone and there was nothing left worth shipping off to Russia. The local civilians plundered what was left, and stripped the place clean of everything. They took doors, pipes, wood, heaters, tools, in fact anything of use in devastated post-WWII Germany.

Although the complex itself was never targeted by Allied bombers, the nearby Junkers factory Zweigwerk Halberstadt and airstrip were. Civilian houses suffered and after the war some of the homeless people lived in nearby caves until housing was rebuilt; this took many, many years and it is reported that people were still living in the caves in the late 1960s…

As mentioned at the beginning of the text, it should be noted that there were two other underground installations nearby, both considerably smaller but part of the 'Malachit' unit. Due to severe Allied bombing in 1944, the Zweigwerk Halberstadt factory was transferred into two former mushroom caves, and were known by their respective code names of 'Makrele I' and 'Makrele II'. Both situated in old underground quarries about three kms south of Halberstadt town, Makrele I was larger than Makrele II as the original pre-1944 site had been considerably enlarged in March 1944. Production began in December 1944. There were approximately 2km of tunnels with a total floor area of 70,000 sq ft of which 40,000 sq ft was workshop use, the rest storage. All galleries were 7m wide and 5m high, were unlined, but whitewashed. Where there had been roof falls (several intersections suffered) reinforced concrete arches were used.

Makrele I was being constructed to produce fuselages for Junkers 162 aircraft and wings for Junkers 88 aircraft. There are no figures or details relating to the size or make-up of the workforce. All access was by lorry. Nearby there were a number of natural caves which were also used for construction purposes, area totalling about 6000 sq ft.

Makrele II was much smaller with a floor area of a mere 9000 sq ft with galleries 7m x 4m with whitewashed sides. Basically a series of linked caves, with rudimentary heating and ventilation, this small factory produced detail parts for Junkers aircraft (not engine components) with machine tools. The total number of people employed was around two hundred, of whom seventy percent were foreign but said to be volunteers.

Both of these former factories are now privately owned and are back to being mushroom caves.

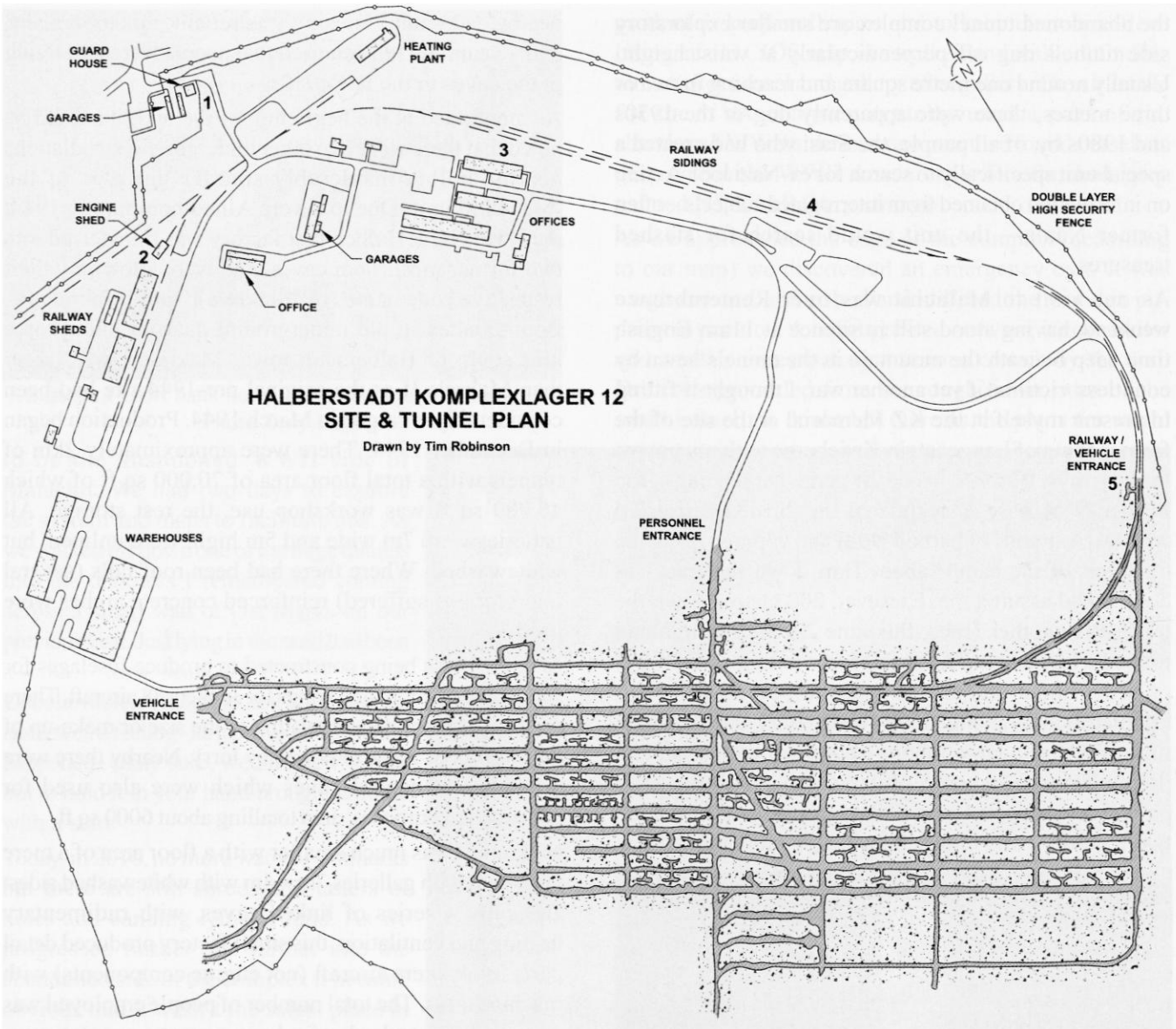
Later History of Halberstadt

by Edward Combes

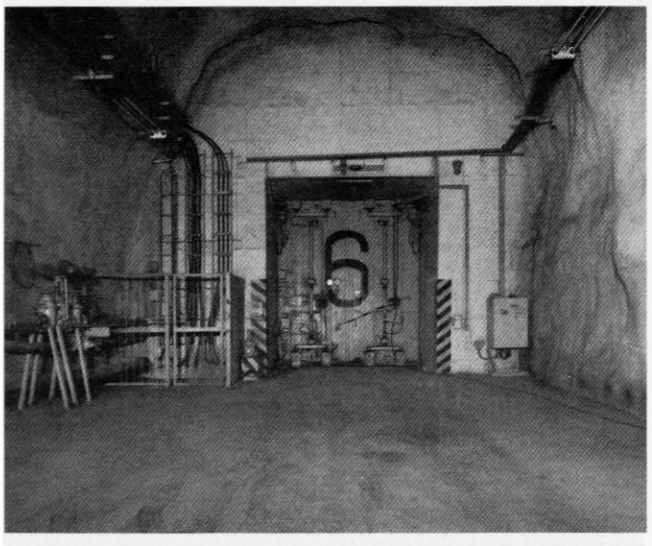
After WWII the bunkers were looted and stripped of the Junkers equipment by the Red Army and plans were set in place to demolish the system by caving it in completely. The 'T' shaped sections on the plan indicate the chambers where the Russians were going to plant explosives to bring the tunnels down, but this never came about and instead the tunnels were retained in case they had a defensive or storage use in the future.

Cold War period

In 1976 control of the tunnels was taken over by Ministerium für Nationale Verteidigung (Ministry of National Defence – MfNV), the ministry with overall command of the East German (GDR) Forces. In 1979 the tunnels were extensively enlarged by some 7km and remodelled to form Komplexlager 12, or Forward Supply base 12, to store equipment and supplies for the NVA



5th Army. In 1987 the NVA 5th Army was comprised of 5th Artillery Regiment, 5th SSM Brigade, 5th Air Defence Regiment. 5th SAM Brigade, 5th Artillery Locating Regiment, 5th Anti-tank Battalion, 5th Combat Engineer/ Bridging Regiment, 5th NBC Company, 5th Signals Regiment and 5th Transport Battalion. Quite a bunch of fives!



These blast doors separate the NVA section of the bunker with the remainder of the tunnel network which was not used by the NVA. Photo Nick Catford

The remodelling work was done by civilian contractors and the Engineer Construction Regiment 12 of the NVA. The tunnels were then stocked with 5,500 tons of ammunition and 3,500 tons of clothes and equipment. The tunnels were supplied by train and the ammunition moved around by electric forklift trucks and tractors.

The whole inventory of the bunker could be distributed to the front line in the event of an east/west war in 24 hours thanks to the rail loading dock, which was 960m long, and the 120 electric forklift trucks available in the depot. Every person working in the bunker was trained to operate the forklift trucks and associated equipment. They trained rigorously to maintain this standard and were able to distribute the contents of the depot rapidly even under full Nuclear, Biological and Chemical (NBC) conditions.

At this time the railroad access was realigned and an additional 440m-long surface loading dock was built. The construction works at the site were completed entirely

in 1983 at an equivalent cost of 190 million US dollars and in the 1980s the site was in use as a border troop training area. It also had ranges and driving schools. The site was never meant as anything more than a storage depot and not as a fighting command post. However a command post was provided should the site ever be needed to operate in that role.

After the reunification of Germany at the end of the 1980s, the Bundeswehr took over the tunnels complex in October 1990 and redesignated it as Luftwaffe Materials Depot 52. At this time all the ammunition was removed to be stored elsewhere because regulations prevented the Bundeswehr from storing ammunition underground. The tunnels were extensively modernised and refurbished and the site continued to operate until early 1993 when the site was closed and decommissioning was started.

The main distribution frame in September 2003.
Photo Nick Catford

By 1994 all military articles had been removed and the site was put up for sale. It was purchased by a private individual from Cologne in 1997 with the idea of opening it as a museum and an exhibition centre but unfortunately this hasn't happened because of the dark history of the WWII areas of the site, and the local government are hesitant to let it open as a public museum in case it becomes a shrine for neo-Nazis. The local community want to ensure that the prisoners and inmates of the concentration camps that died during the construction of the tunnels are remembered appropriately.

To summarise, the underground space is split into four main areas.

1) The WWII-era tunnels – originally the Junkers aeroplane factory
2) The Logistics and Intermediate Storage Area – for storing supplies and equipment
3) Ammunition Storage area – 5,000 tons or 90,000 rounds of ammunition were stored here which could be distributed in 24 hours.
4) The Protected Bunker Area – a control centre for the ammunition/equipment distribution.

The whole site is well preserved and dry with the exception of some of the WWII tunnels, which are in a poor state of repair. Remains of WWII German gas masks, weapons and equipment were evident in the further, more sporting, reaches of the WWII tunnels.

Protected Bunker Area

The protected bunker area was a self-contained 'bunker within a bunker' that was designed for 250 core and 100 attached personnel made up of military and civilian workers. It was provided with medical facilities, dormitories, kitchen (the kitchen provided hot food 24/7 for not only for the bunker workers but also for the sentries on the surface) and recreation facilities. It also had filtered and conditioned air, heating plant, water from a borehole, three diesel generators and enough food and fuel stored to enable the bunker to work in isolation for forty days continuously.

It had engineering facilities sufficient to enable anything to be maintained and repaired without any external help at all. It had a very extensive decontamination suite area, with coloured lines on the floor for the people to follow: red for very heavy contamination, blue for medium contamination, and green for no, or minimal, contamination. Each stage was monitored by radiological monitoring equipment, and you were only allowed out of the decontamination area if you passed the tests. This was accomplished with a remotely controlled gate.

Tunnels Galore at Halberstadt

by Tim Robinson

Our weekend at Halberstadt started with the usual early-morning Ryanair flight into Schonefeld, Berlin. Hire cars loaded up, we started the two-hour drive to the site. The weather was predominately wet but that's nothing much to worry about when your destination is underground!

As well as a bumper group of twenty Sub Brit members, we were joined by Sascha and Torsten from Berliner Unterwelten as they had organised the logistics on the Berlin side. Halberstadt KL 12 (KL is the abbreviation for *Komplexlager*) lies 109 km northwest of Leipzig, just south of the village of Halberstadt. There are also four other sites centred around Leipzig making up the 'Komplexlager' group of tunnel systems. Blankenburg KL 2 is 110 km NW, Rothenstein KL 22 is 78 km SW, Kahla KL 22A is 83 km SW and Lohmen KL 32 is 123 km SE.

The turning to the site consisted of a very rough track across fields already showing signs of being waterlogged. On we drove, weaving between the pot holes where possible. Eventually a double wire fence started to appear on the right and the first signs of the craggy outcrop

The Money Tunnels

by Tony Page

The reunification of Germany took place on 3 October 1990 and the GDR, created out of the ruins of WWII on 7 October 1949, was no more. However, the monetary and economic union of Germany had occurred on 1 July 1990 and the DM (Deutsche Mark) became the currency of East Germany. This left around 4,500 tonnes of now-obsolete East German coins and banknotes which had to be disposed of, and most of the coins were destroyed at the Rackwitz metal works throughout late 1990.

An unissued 500 Mark note from Halberstadt

Some of the paper money was coated with a plastic substance which technically designated it hazardous waste! Simply burning it was not an option so; instead, the government opted to bury it... in a former underground military bunker complex. During late 1990 and into 1991, almost all the paper money of the GDR was brought by military convoy from the Staatsbank der DDR in Berlin and buried – placed in two disused tunnels in Malachit, each three hundred metres long. This amounted to about 100 billion E. Mark, made up of 620 million banknotes – a volume of 4,500 cubic metres. To put that into perspective, it all weighed over 3,000 tonnes and would have filled about three hundred railway wagons.

This included all the currency collected at the time of the monetary union and the never-used 200 and 500 Mark banknotes (in fact printed in 1971 and 1984, but never circulated), passbooks, chequebooks, travellers' cheques and special notes intended for use by NVA/Soviet Military Missions but, again, never issued or used. In 1955, East Germany printed these special military banknotes, never circulated, in denominations from 5 to 100 Marks. Preparations were made to introduce them in 1980, but were never carried out.

Deep underground, it was considered that the money was protected from theft by the two-metre thick concrete walls and massive heavy steel doors into the complex. For cost reasons, the money was left to rot under the natural humidity, but it was further covered with gravel.

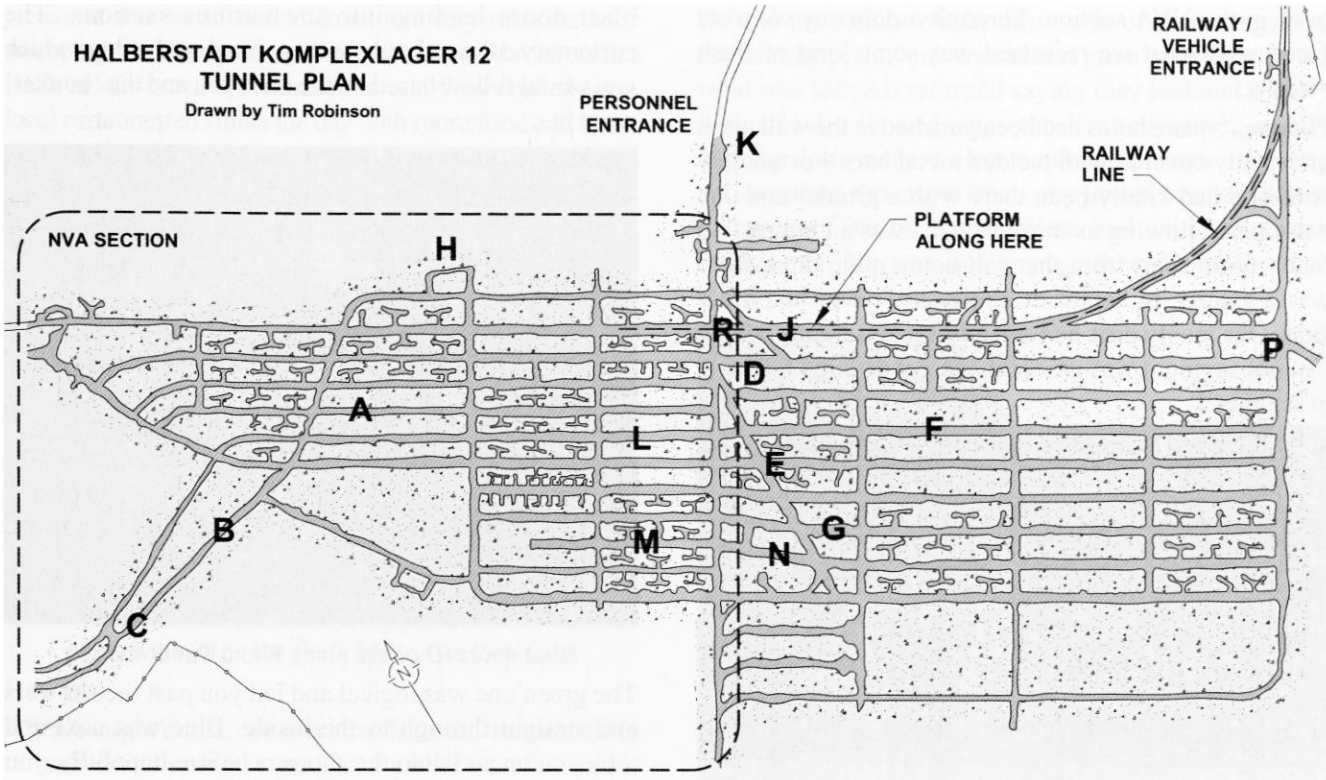
However, in July 2001, it was discovered that two enterprising Halberstadt residents had broken into the tunnel system through an unsecured opening and made off with numerous banknotes. The two, aged 24 and 26, were convicted of the crime and sentenced to four months in prison and three years of probation. What had given them away was the sudden appearance among collectors of uncirculated 200 and 500 Mark notes, and of the never-issued military currency. Unbelievably, the would-be currency vendors had used eBay as their marketing tool.

It was then decided to burn the currency, so between April and June 2002, it was all dug out and 298 containers of redundant GDR notes were hauled off and incinerated at a rate of six containers per day along with household refuse. The last container was burned on 25 June 2002.

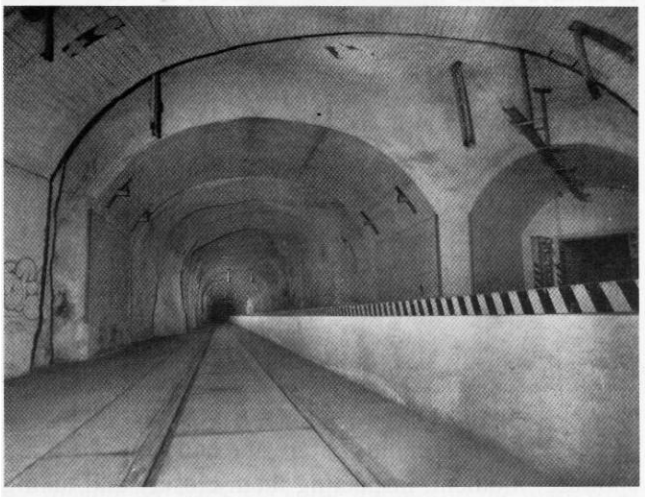
Today degraded travellers cheques can still occasionally be found in the tunnels

Halberstadt KL was carved into. We were delighted to see our host waiting at the main gate

There were plenty of surface buildings to explore but the first order of the day was to go on a brief tour of the site and tunnels with our guide, the former commanding officer of the GDR-Depot and the last Commander when the Bundeswehr occupied the site. We stopped at various points along the road and heard information as to what the buildings were used for and how the site operated in the Bundeswehr days. Finally we headed for the tunnels themselves which really started the weekend for us.



We wound our way along the site road but with dense undergrowth on all sides, it was only after we turned right at the end of the road that we saw the entrance. It was huge and easy to imagine trains heading into there and the doors being closed behind them. In convoy we slowly drove into the tunnels and followed the train tracks round to the platform, a common feature of the Komplexlager sites. This just kept going on and on though I'd not checked the odometer to see just how long it was! Eventually we pulled over at the end of the platform and all got out for the next part of the historical tour.



The platform (R on the plan). Photo Tim Robinson

A quick walk took us to one of the areas where the WWII tunnels remained and it was clear by the signs that the brick linings of these tunnels were not in the best condition. The areas that were 'safe' were very impressive, the linings having been neatly cut into each other as the vaults met overhead. The famous 'money tunnel' described earlier was pointed out so we could find it later on when we were off the reins.

Orientation

Back in the cars, we took a short drive round to another area, the former NVA part of the tunnel system. The complete system had been constructed by the Nazis in WWII but due to time and money limitations, it was never fully completed. When the NVA inherited it they decided they only needed half of the system so it made sense to use the parts the Nazis had finished and leave the rest.

This area can be seen on the plan as can references (letters) to the photos in this article. External photo references (numbers) are shown on the overall site plan. In the NVA section, walls were finished properly and there were far more 'normal' sized rooms. We stopped at various places for the next piece of information, superbly translated by Sascha. All too soon we were back at the cars and our guide bade us farewell for the rest of the day.

Now the proper exploring was to start but under strict rules from Sascha. We had to stay within earshot / sight of the members from our cars and no wandering off on our own. This all sounded quite melodramatic to start with but as we headed off in different directions our voices were lost in the vastness and I for one, was glad I could see the rest of my group.

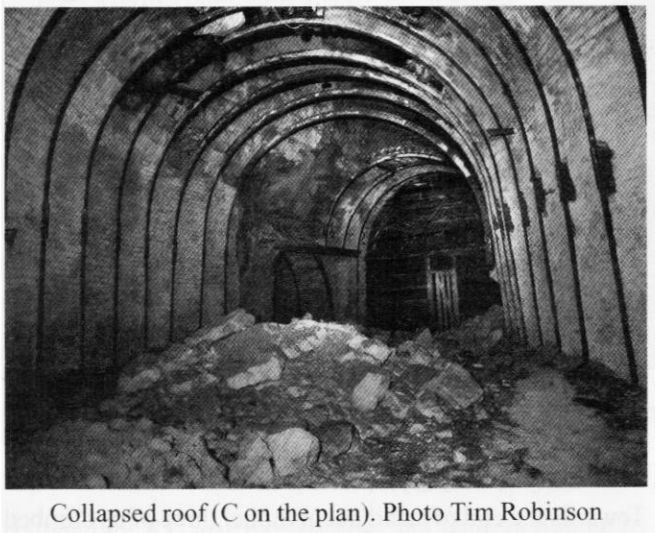
Towards the end of an adjacent tunnel three of us climbed through a hatch and found ourselves in an unlined section. This was just as impressive as it had been rock bolted and some attempt to finish the ceiling had been made before something else distracted the builders. This tunnel eventually led to another hatch and we found ourselves

back in the NVA section. Through a doorway we were faced with what we reckoned was some kind of fresh air inlet.

Fourteen square holes had been punched in the wall, each one neatly covered with welded metal bars. Fortunately someone had kindly been there with a grinder and one was open, allowing us through. This was an interesting feat – quite apart from the wall being quite thick there was a change in height of about six feet on the other side. Our team spirit had already kicked in and whilst I'm not saying it was graceful, we got through one way or another!

Brickwork and cast iron lining (B on the plan). Photo Tim Robinson

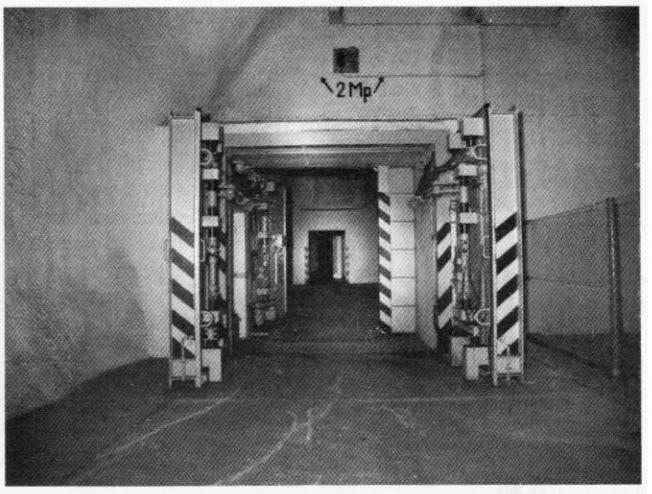
Yet again it was unlined but had some attempts at a secondary lining in the form of brickwork panels. Some kind of cast-iron structure had also been incorporated though this was not very substantial and had collapsed in places. Likewise the roof had collapsed in great piles of bricks and rock and after a while we decided we'd seen enough and headed back.



Collapsed roof (C on the plan). Photo Tim Robinson

Decontamination

Lunch / afternoon tea was briefly taken at the car before we walked back along the platform and started exploring the NVA areas we'd seen earlier on our guided tour. The decontamination area was very impressive with huge blast doors leading into the various sections. The customary coloured paths were painted on the floor which you would follow based on the state you and the 'bunker' were in.



Blast doors (D on the plan). Photo Tim Robinson

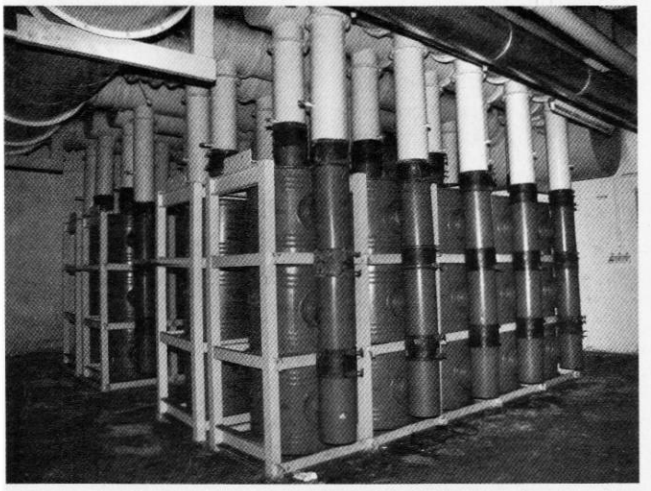
The green one was logical and led you past the showers and straight through to the inside. Blue was next and took you on a visit to the showers before hopefully, you crossed to the green route. Red was a little more interesting, following the return to the showers but then taking you upstairs and round several circuits of the large room where wires were strung up possibly for changing clothes. You then went back downstairs and back to the showers. None of us could work out if the idea was to tire you out before they set you free back in the dirty side or if eventually these circuits led back to the green route!

Rooms followed rooms as we explored deeper into the bunker area. Dormitories were quite abundant as were washrooms. Plenty of equipment was still in place which is always good to see though most of it was covered with a fine layer of soot from the usual burning of electrical cabling for scrap. We had been shown a huge tunnel section where this had taken place and the pungent, toxic smell hit us as soon as we ventured more than a few feet into the space. It must have been appalling when it was all alight; the line of smoke was clearly visible on the adjoining tunnels.

In the filter room the drum filters were still in place dated 08-1978. A Soviet manufacturer's plate also confirmed the installation date as 1978. The rectangular filter housing we often see in Soviet bunkers around Berlin was here as well but with the added gem of the filters being in place. I'd never seen this before and had a bit of a 'train spotting' moment, inspecting them closely and taking several photos. I'm sure I could hear the rest of my group slowly edging back as I continued to voice what a find this was!

Time had now caught up with us so we headed back to the car and then to the tunnel entrance where a local restaurant had driven over to serve us hot food, mulled wine and beer. After a full day exploring, this was very

welcome and we all settled down to a very relaxing hour swapping discoveries and taking in what we'd seen so far. Back at our hotel, we checked in and then headed for a local restaurant to finish the day with more food and beer.

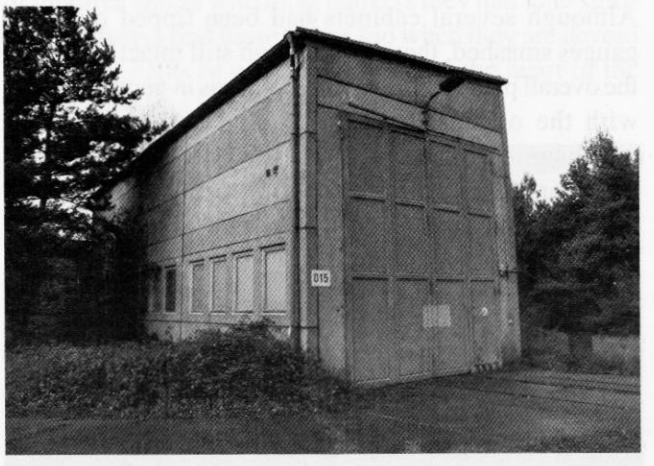


Filter bank (G on the plan). Photo Tim Robinson

Day two

After a night's rest, we were back to the tunnels fully refreshed and raring to go. The weather was fine and it was decided we should do some of the surface buildings in case the rain from the previous day reappeared.

Walking down from the guardhouse we came to the main road junction – left to the tunnels, right to the engine railway sheds and warehouses. Everyone was fairly well spread out now and it was comical to see people disappear into various buildings only to reappear somewhere else. The engine shed was sadly locked and despite attempts to see through the windows none of us found out what it contained.



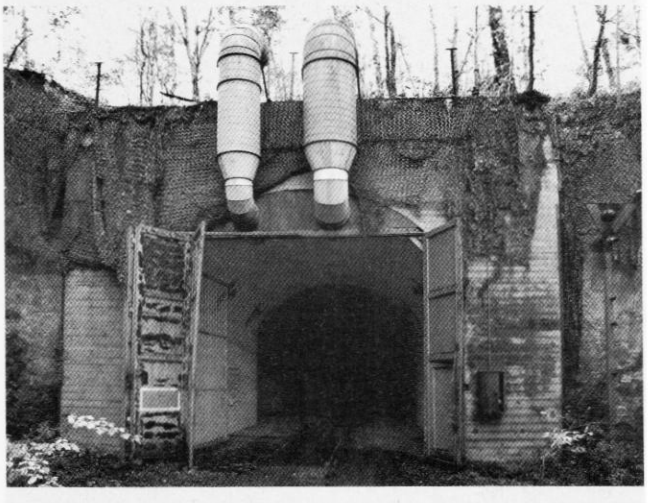
Engine shed (2 on the site plan). Photo Tim Robinson

The railway sheds were being used for hay storage so we meandered back via some garages to the main road and office area. One building in particular was clearly being used by someone for living in but several rooms still had their original furniture with documents and drawings on the walls including the full site plan showing absolutely everything. A control desk was still intact so we deduced this was the nerve centre for the site, quite possibly used by our guide when he was stationed here.

Behind the offices on the other side of the sidings was the heating plant, and several had gone over there to see what was left. All returned saying they had met a scary woman who looked after the kennels where wildly barking dogs made it clear neither was keen on seeing us! Avoiding this experience, my group went to look at the sidings which Robin Ware had said were very impressive. He was not wrong; they disappeared to infinity in both directions.

Sidings (4 on the site plan). Photo Nick Catford

By chance our guide reappeared, bait bucket in hand, explaining that we needed to show a degree of caution as his daughter was round about shooting. We were assured the bait was not for us but for wild boar that plagued the site and made good eating! In his limited English he explained that the sidings were this long so they could accommodate an ammunition train in one straight line. This made unloading much easier which the women stationed here undertook. They were regularly required to practise this and within a few months the women could unload a complete train and take the ammo to the allotted areas in the tunnels in under two hours!



The train entrance (5 on the site plan). Photo Tim Robinson

The 'money tunnel'

Heading back to the tunnels, we had a chance to look at the impressive train entrance with its huge doors, vent ducts and signals. Our first port of call was the money

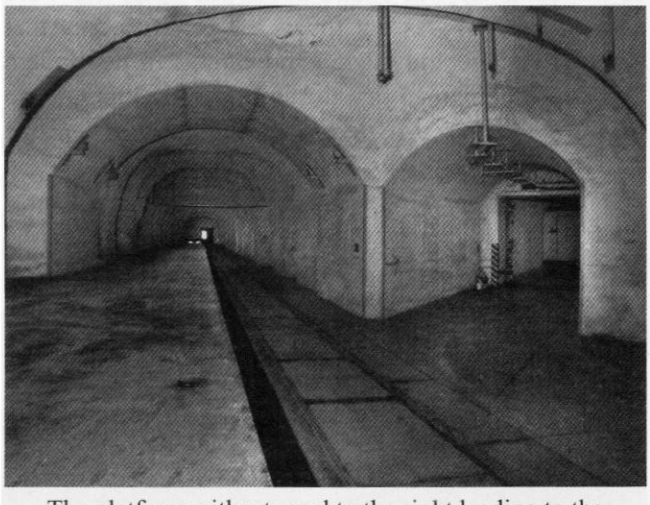
tunnel which several had visited the day before and found plenty of evidence of the money. We were not disappointed either though it took you a while to get your eye in. Initially we all thought the wall was just rough-cut rock again but upon closer inspection scraps of banknotes could be clearly seen. All of it was so degraded that as soon as you tried to retrieve some, it crumbled to nothing – although perseverance did prevail in the end.

This tunnel was a simple loop which reappeared further down the secondary entrance tunnel, this ending in a full-height metal grille which started the formal public part of the site. This was a tiny, maybe less than one percent in reality, but gave those with limited time or curiosity a good idea what the complex was about.

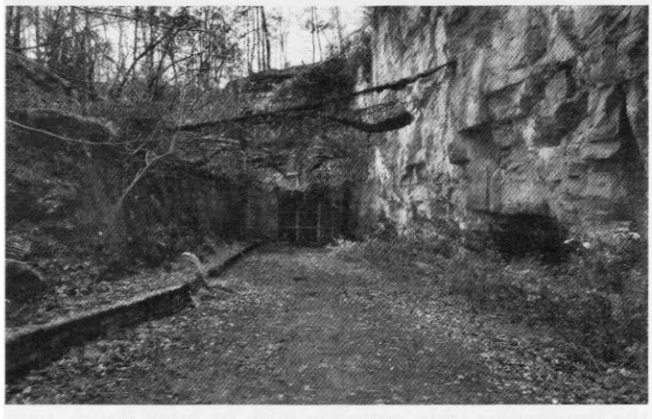
Our objectives for day two were to walk the rest of the main tunnels, platform, return to the NVA bunker section to ensure we'd completed that and then investigate anything else we could find.

To the Control Room

Midway along the platform was the small underpass access to the personnel entrance consisting of a staircase down, corridor under the platform and track and staircase back up into a guarded area. Exit from this was via a caged box which led directly to the entrance tunnel. Back at the platform we visited one of several small control rooms dotted along its length.

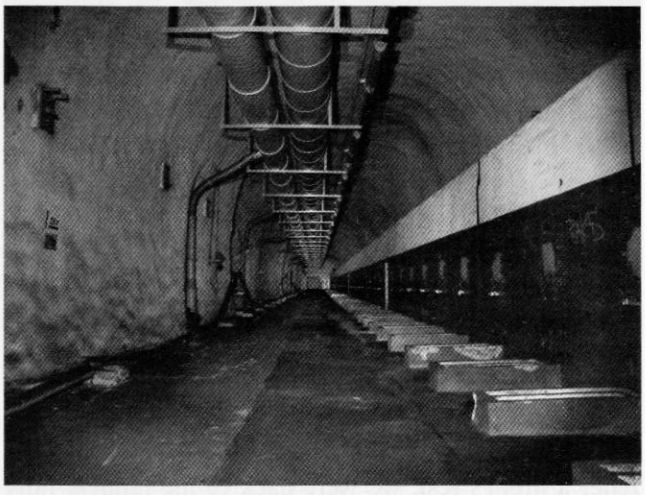


The platform with a tunnel to the right leading to the personnel entrance (J on the plan). Photo Tim Robinson



The personnel entrance (K on the plan).
Photo Nick Catford

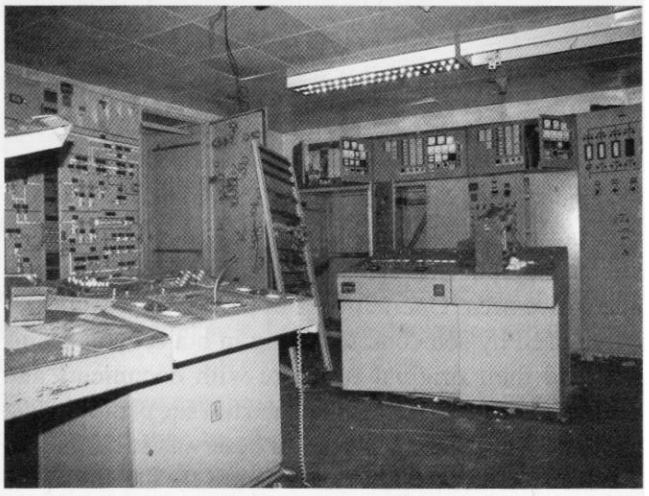
Sitting forlornly in the corner was a control desk, dirty and silent, but no doubt one that controlled many of the blast doors we had passed through on our travels. Turning right we found ourselves in the electric-cart battery-recharging room, an incredibly long tunnel with concrete base stations along one side and amazingly huge bottles of battery acid still in their baskets with hay protection.



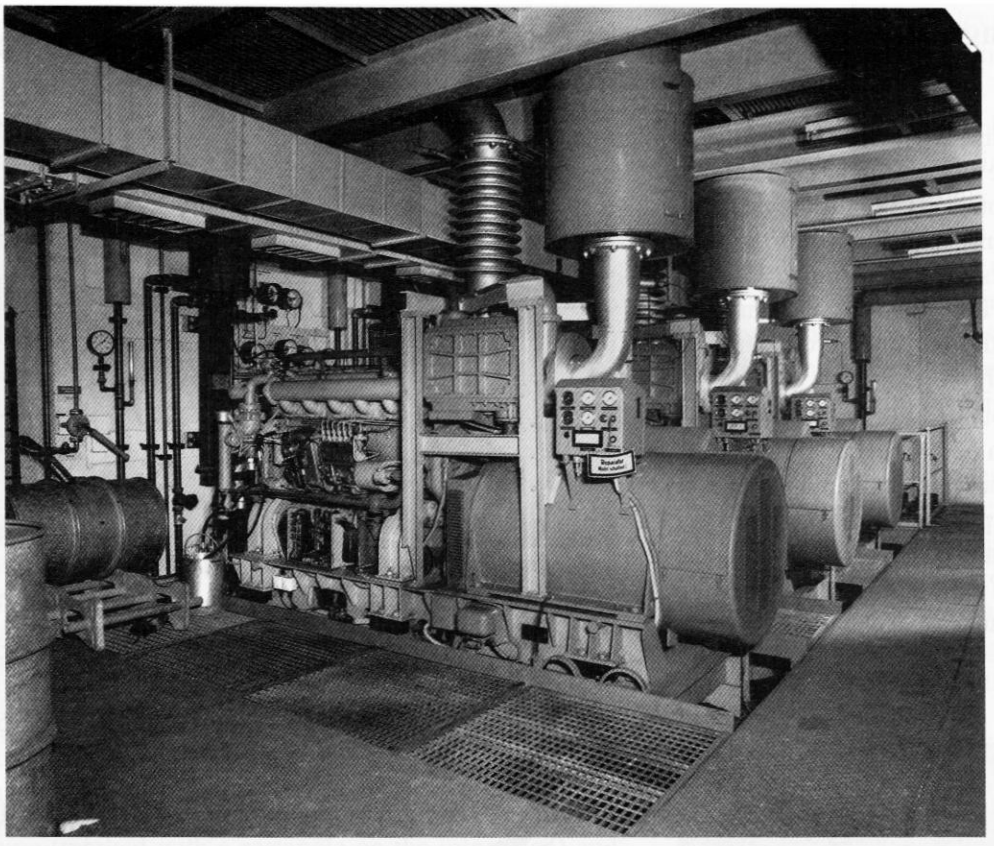
Battery room entrance (L on the plan).
Photo Tim Robinson

The NVA area beckoned again now as we had only done a tiny part yesterday and plenty of gems still lay in wait. It took a few wrong turns and shouts of "not this way" before we found the right corridor that led firstly to the control room. Nick and Robin had both said it was in almost perfect condition when they first visited and they were right, it had seen better days.

Time is never kind to the places we like to explore but add in pointless vandalism and the result is never good. Although several cabinets had been tipped over and gauges smashed, there was enough still intact to give us the overall picture. The control desk was in good condition with the original anglepoise light and handwritten telephone extension numbers stuck to the shade. The indicator board was also intact with its reflective coloured diagrammatic representations of the various services being monitored.



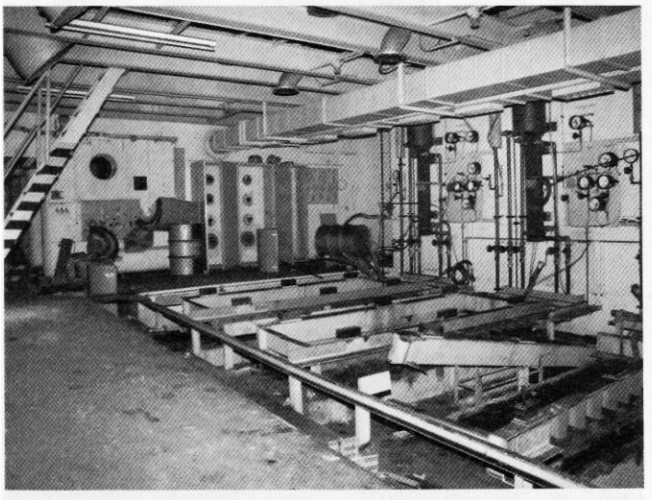
Control room (M on the plan). Photo Tim Robinson

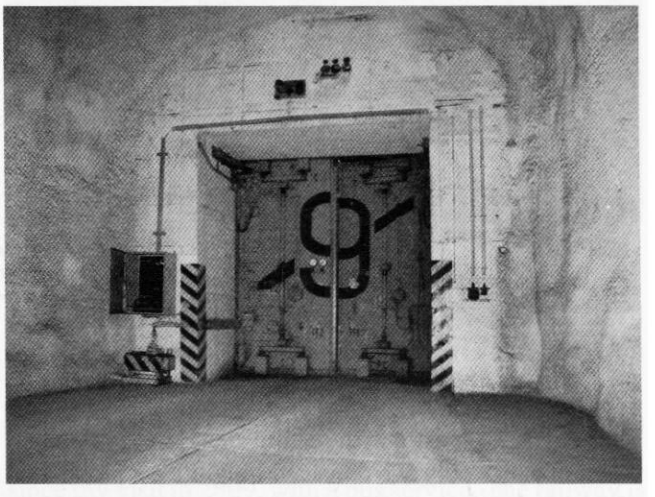


The generator room in September 2003, at this time the generators were still in pristine condition (N on the plan). Photo Nick Catford

Crossing the corridor we entered the kitchen and stores area. A few items of industrial cooking remained such as big freezers, cookers and preparation areas. A discarded line of coat hooks with names reminded us that people did once live and work down here. Yet again time was not on our side and with our drive back to the airport pressing we started to work our way back to the main entrance. En route we bumped into Ed and Julian who were attempting to shut one of the huge main blast doors. It was an impressive sight when they finally got it closed!

Further along the corridor was the computer room containing plenty of empty racks, the telephone exchange with the main frame in place and loads of equipment still in situ and a small office with the phone exchange console against the wall. The generators were at the beginning of this area and as with most bunkers they had long since gone. I always find these rooms sad when they are devoid of the key items of equipment as I feel the heart of the bunker has been ripped out.





The main blast doors (P on the plan). Photo Tim Robinson

Farewell

We gradually started meeting the rest of the group and eventually arrived to find our restaurant hosts from the previous afternoon had returned to serve more food and drinks. An ideal end to a superb day's exploring! All that remained was for us to head back to Schonefeld and drop off the cars. We bade our farewells to Sascha and Torsten at the airport and headed to the Movenpick, preferred hostelry of the Sub Brit explorer.

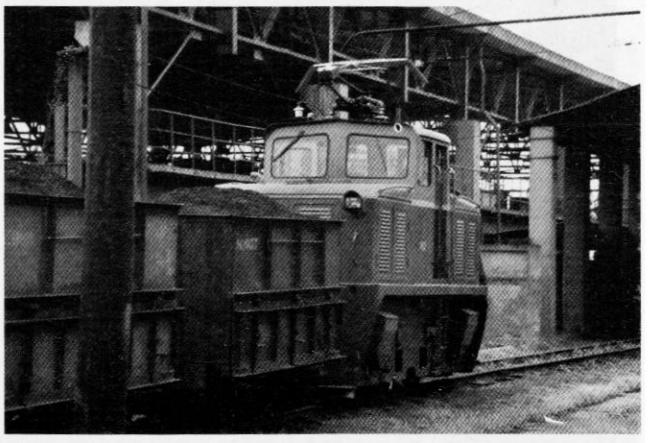
Many thanks go to Sascha and Torsten for their arrangements and help throughout this trip. Everyone thoroughly enjoyed themselves seeing one of the most famous of the Komplexlager tunnel systems.

Exploring the 'sole tourist mine wells' of Huangcun in China

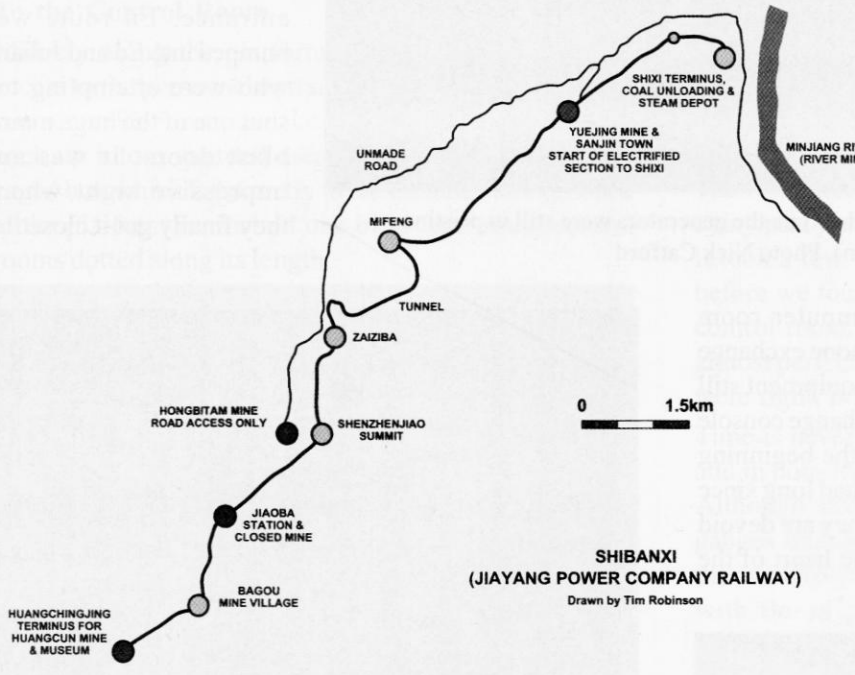
by Ken Geddes

For a country the size of China, all but floating on coal, it is surprising that only one underground coal mining museum exists. But as the notice in Chinglish says: "Take the world's out-of-print Jiayang small steam train. Explore the sole tourist mine wells of Huangcun in China". Roughly translated, this is "Take the historic steam train on the Jiayang line and visit the only underground mining museum in China". Naturally, I did.

The mining company was founded as a Sino-British joint venture in 1938. Perhaps an odd time, but the Japanese did not reach Sichuan Province, and the mining village of Bagou became a centre of production of materials for the Chinese Army in WWII and possibly later, during the civil war. The location of the mines, railway and museum is in Qianwei County, Leshan City, Sichuan.



Wagons of coal bound for the depot at Shixi.
Photo Ken Geddes



The Inch Railway

There were at least six mines up the Bajiao (Banana) valley of which only two now have a significant production of coal. Prior to the railway, coal was transported to the Minjiang river by packhorse. 700,000 tonnes per annum were carried in the heyday of the railway and by 2005 a total of 19.5 million tonnes of coal had been mined.

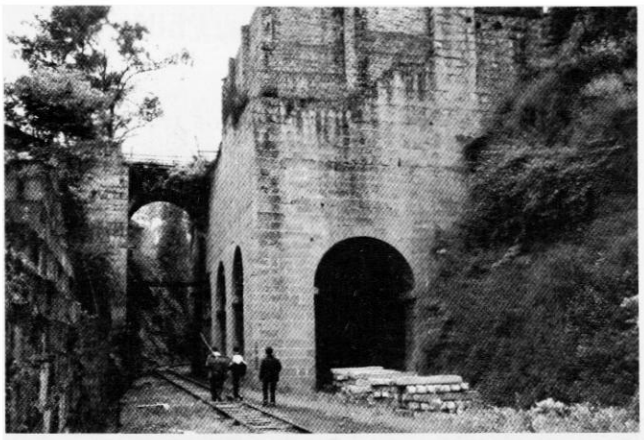
After the revolution, China was becoming industrialised through "The Great Leap Forward", and in 1958 the 20km-long railway was built with help from the Chongqing Ironworks. The continuing British influence, however, ensured that it was constructed to the 2 feet 6 inch gauge (762mm) – and also explains the popular local sport of croquet! The line is known as "the inch railway" up the valley. In all, fifteen Type 3 (C2) 0-8-0 engines were obtained from the Shijiazhuang Motive Power Machinery Works and later two diesels from Mudanjiang, but these are now derelict as they are uneconomic to run. The passenger coaches were made by the railway employees themselves.

The railway was opened on 12 July 1959 after a very slow commissioning, due no doubt to the steepness of the gradient and the curves of 70m radius. The railway served four mines, but I did not see the one at Yuejing. Mines are worked from both shafts and adits and those away from the railway are small and use road vehicles to carry out their coal over the unmade road. The railway is now owned by the Jiayang Power Company, whose power stations are by the river, below the town. The track does not reach here and coal is carried from the concentration depot in Shixi to the power station by large road lorries.

The largest operation is the Weijin mine at Sanjin; reputedly one of the biggest in Sichuan Province. This has a railway shuttle down to the coal concentration depot at Shixi operated by small electric locomotives, powered from trolley poles. All the coal wagons are of the triangular divided variety and discharge into gratings leading to a large chute down to the storage area.

The steam depot is alongside, where many of the spares are produced in the workshop. The disused mine at Jiaoba seems to not have been used for many years. The adit mouth shows evidence of a fire, but whether this was local or in the mine itself is impossible to tell. Behind and above the adit mouth there are extensive remains of mine buildings, steam pipes and a large tank of water, all hidden amongst the trees and undergrowth.

The village is a pleasant place. Huangcun mine at Huangchingjing is at the top of the line, still working, but nearly exhausted. The "mine town" at Bago is grim but



Loading facilities at Jiaoba Mine. Photo Ken Geddes

interesting, with remains of extensive hospitals and administrative headquarters, including a stage from where party rallies were addressed. Most buildings are disused or converted to other purposes; there is a small central park and a market. The mine at Hongbitang can be reached by footpath from Shenzhenjiao station. This is the source of the coal carried by lorries on the unmade road.

The Mining Museum

The museum is in a small worked-out corner of Huangcun mine (marked with a rectangle on the mine map) and admission is about £2 for an escorted tour. It is accessed by original steps alongside an unusual curved incline, now otherwise abandoned. I would guess the depth to the museum at shaft-bottom level to be around seventy feet. We were provided with hard hats, lights and self-rescuers.

Original headgear from when the mine opened in 1938

The museum director was obviously delighted to see us and we may have been his first foreign visitors, the show mine having been open only a short while. Unfortunately his English was rustier than some of the artefacts and an emergency translator from a nearby office did not help much as she was unfamiliar with the mining terms in Chinese, never mind English! It was fairly easy for me to understand what I was seeing, so I largely took over the descriptions with the Director adding his comments afterwards.

The museum has overtones of Caphouse and the Big Pit, which may not be coincidental. In all, we spent two and a half hours underground instead of the scheduled 45 minutes; luckily there were no other visitors! Photography was allowed as the area was well ventilated. There were several tempting passages leading out of the museum area, but I didn't try to negotiate an extension to the tour!

Tubs of coal being manually pushed from Huangchunjing adit at Huangum Mine. Photo Ken Geddes

The museum was interesting, educational and well presented. You even get the chance to use a pick-axe on a real seam of coal. It is often fun without being silly. Unfortunately the steam locos are a nightmare to keep running and a motor road has been built up the valley since my visit in 2009, with a bus service. The railway is heavily subsidised by the Sichuan provincial government, so whether this will be justified is anyone's guess when new diesels are hauling the coal and a tourist steam train service just runs a few times a day.

Afterwards we strolled up to the working mine where we were welcomed in the yard, watching the side-tipping tubs of coal being manually pushed out of the mine and unloaded, but entry into the adit was strictly forbidden. The coal is nearly worked out, so this may be the final nail in the coffin for the narrow-gauge railway, at least as a working line.

It is intended to develop the valley for tourism, but it is in a remote location, so what are the chances of the museum surviving?

World War II tunnels on Corregidor Island, Manila Harbour, Luzon, Philippines

By Paul W. Sowan

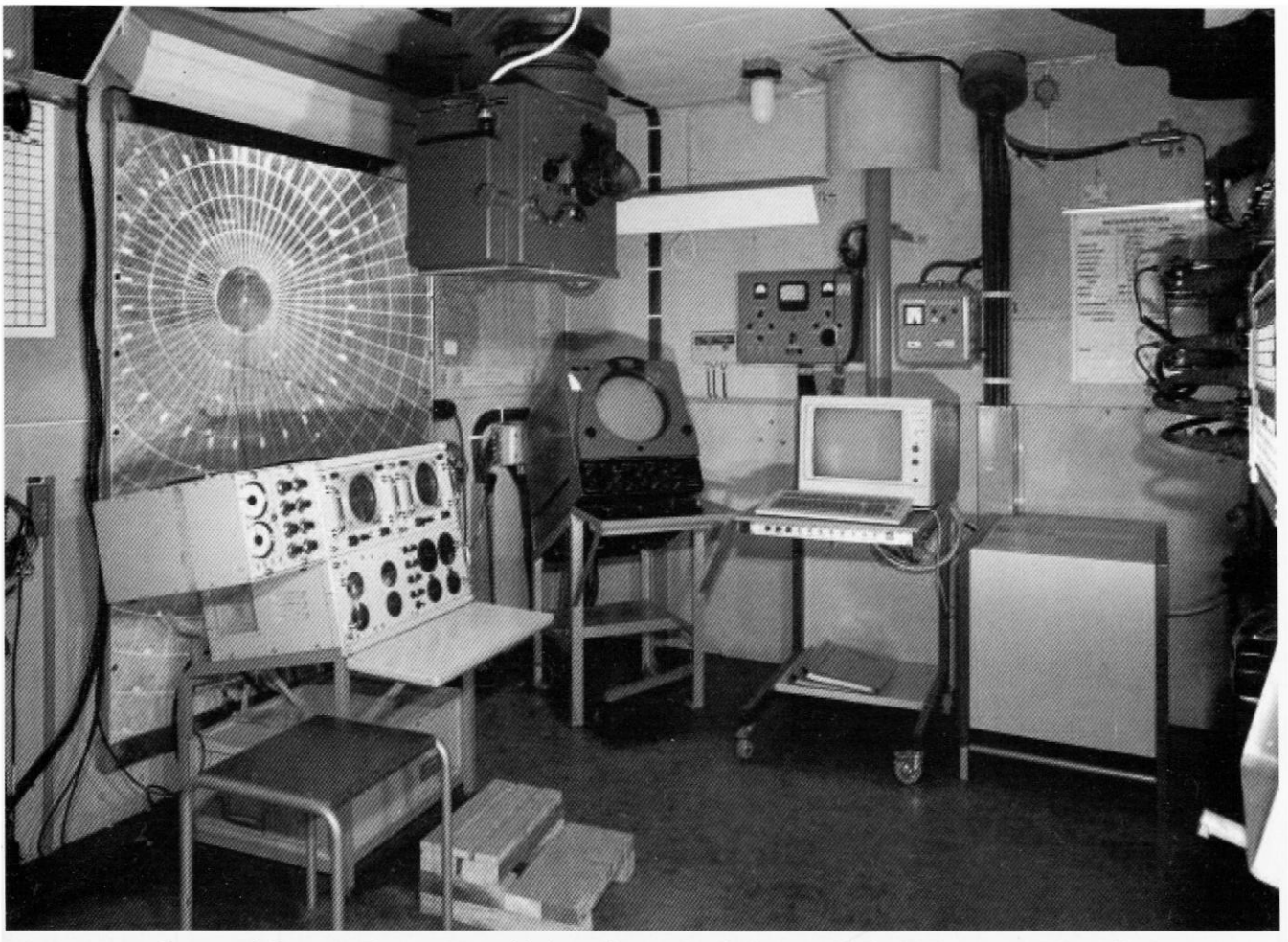
What has since 1946 been the Independent Republic of the Philippines, an archipelago of over 7,100 islands, was claimed for Spain by Ferdinand Magellan [c. 1480 - 1521] in 1521, occupied briefly (1762 – 64) by the British, and ceded to the United States of America after the Spanish-American War in 1898. The capital, Manila, lies within Manila Bay on the west coast of Luzon, the largest and northernmost of the islands. This enormous natural harbour, said to be the finest in the world, is thirty miles long and up to 35 miles wide. Access to the China Sea or the Pacific Ocean is by way of narrow straits only 11 miles wide. Corregidor is the largest of four small rocky islands spanning the straits, ideally placed for defensive fortifications.

The volcanic rock of Corregidor, rising to a height of over six hundred feet above sea level, occupies an area on plan of only two square miles. To the east of the main rock massif is lower land, where is Malinta Hill, and a long narrow eastward-pointing 'tail' to the tadpole-shaped island. Like Gibraltar, 'The Rock' was extensively tunnelled for military purposes. The large network under Malinta Hill dates from the 1920s onwards and comprised over 65 miles of tunnels including 13 miles of electric railway track. It hardly surprising that this key to such a fine harbour and base was an early objective of the Japanese during World War II, and it was indeed captured by them in May 1942, following their assault on Pearl Harbour on 7 December 1941.

E.M. Flanagan's account describes the island, and its recapture by the Americans in 1945.The Japanese, unfortunately from their point of view, had concluded that assault by paratroopers (followed up by air and sea support) on a handful of very small possible drop zones (the largest 125 yards by 315 yards) on the highest ground on such a tiny, precipitously-sided rocky islet was impossible. Any attack was expected to be by sea. The Americans, on the other hand, had greatly under-estimated the numbers of Japanese on (and inside) the rock. In fact an invading force of 2,700 men, after one of the most hideous 12-day battles on record (16 - 28 February 1945), retook the island from an estimated 6,000 Japanese. In the warm tropical climate, thousands of flies, which had thrived and multiplied on the rapidly rotting corpses which littered the small space, made the still-living soldiers' lives even more of a misery than it would otherwise have been.

The Japanese, described by Flanagan as 'fanatical, obstinate and single-minded', hid and fired from innumerable bunkers, and small caves and tunnels as well as the main underground Malinta Hill complex. He notes mass-ritual suicides and Banzai attacks. The Americans, portrayed as the more civilised force, sealed their enemies underground by blowing-up tunnel entrances, or killed them underground or forced them out into the open using napalm and white phosphorus incendiaries dropped down ventilation shafts or fired into tunnels. Japanese dead were estimated at about 4,500 killed, 200 killed whilst trying to escape by swimming for Mainland Luzon, 118 others, and perhaps 500 buried alive. Twenty were taken as prisoners of war. American losses were 214 dead. Curiously, about 20 Japanese survived on the island, hiding in unsealed tunnels, unaware of their nation's defeat until one of their number found an abandoned American newspaper: they emerged and surrendered on 1 January 1946!

According to Flanagan, the island was, in 1988, a jungle-covered pile of rock and ruins, with a neglected Pacific War Memorial. A large part of the Malinta Hill tunnel complex was blown up when, whether deliberately by the Japanese or as the result of American actions, quantities of explosives stored underground were detonated. Much the same happened at a smaller tunnel complex incorporating an underground Radio Intercept Station at Monkey Point, near the eastern end of the island. The Americans used 17 tons of explosive to close the entrances to over 400 'caves and tunnels.' An estimated 500 Japanese may have been buried alive as a result.



Command Centre at Femore Fort with the periscope for the battery chief, plotting map on the wall and one of the two radar screens in the centre. Photo Nick Catford

The control room at Halberstadt in September 2003. At this time the bunker was still in excellent condition. Compare this with the picture of the control room in 2010 on page 64. Photo Nick Catford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